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Trinodes puetzi sp. nov., a new fossil species described from the Baltic Amber (Coleoptera: Dermestidae)

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Abstract. A new fossil dermestid beetle *Trinodes puetzi* sp. nov. from the Baltic amber (Eocene–Oligocene) of the Russia (Kaliningradskaya oblast) is described and compared with related extant species. New species differs from all known species by the form of antennal club, especially by the relative length and the form of terminal antennomere.

Taxonomy, fossil, new species, distribution, Coleoptera, Dermestidae, Trinodinae, amber, Tertiary, Eocene, Oligocene

INTRODUCTION

The present study follows the preceding paper about fossil Dermestidae from the Dominican amber (Háva & Prokop 2004). Baltic amber is the world most well-known source of amber dated from Late Eocene to Early Oligocene between 40 to 35 Ma. Although, the plant producer of Baltic amber is still uncertain, sharing characters with pines and araucarians (Poinar 1992).

The genus *Trinodes* Dejean, 1821 contains 16 species distributed in the Palaearctic, Afrotropical and Oriental regions, with six known species from the Palaearctic region (Háva 2003). The fossil record of genus *Trinodes* is entirely known from Baltic amber and noticed by Larsson (1978), Spahr (1981) and Hieke & Pietrzeniuk (1984).

MATERIAL AND METHODS

Insect inclusions are preserved in polished pieces of transparent amber without any further fixation. Standard techniques of observation by stereomicroscope (Olympus SZX 9) and digital photography (Olympus 5060) were used.

Because the size of beetles or their body parts can be useful in species recognition, following measurements were made:
(a) total length (TL) – linear distance from anterior margin of pronotum to apex of elytra.
(b) elytral width (EW) – maximal linear transverse distance.

We follow classification of Dermestidae as proposed by Zhantiev (2000) amended by Háva (2003, 2004).

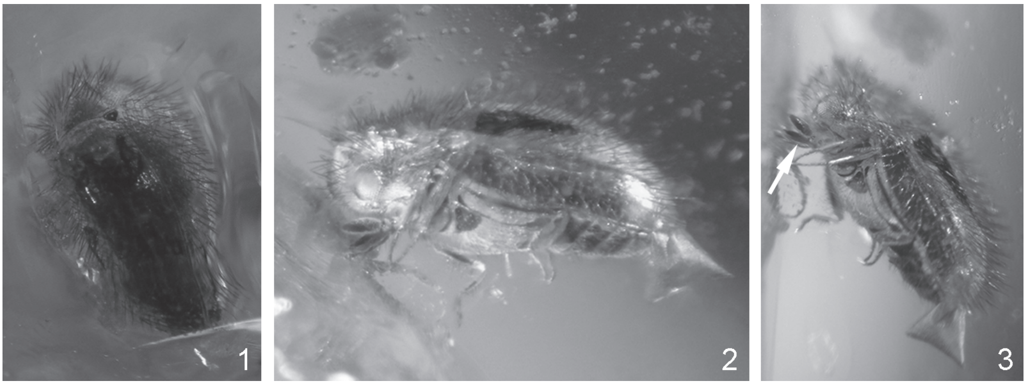
SYSTEMATIC PALAEONTOLOGY

Trinodes puetzi sp. nov.
(Figs 1–3)

Trinodes rufescens: Háva 2003: 52.

TYPE MATERIAL. **Holotype** (male): Amber inclusion from the "Baltischer Bernstein, Fundort: Jantarnyi bei, Kaliningrad", Eocene–Oligocene age. **Paratype** (male): the same data as holotype. Holotype deposited in the coll. A. Pütz (Eisenhüttenstadt, Germany) [later in Deutches Entomologisches Institut, Müncheberg, former in Eberswalde, Germany] and paratype deposited in the coll. J. Háva (Prague, Czech Republic). Holotype and paratype specimens provided with label: "HOLOTYPE [PARATYPE respectivelly] *Trinodes puetzi* sp. nov. Jiří Háva & Jakub Prokop det. 2004" [red label, printed].

Description of the holotype. Male. Measurements (mm): TL 1.6 EW 1.0. Head and pronotum dark brown to black, elytra dark brown to black, body oval, convex (Figs 1, 2). Head dark brown finely punctate with long black erected pubescence. Palpi entirely brown. Frontal median ocellus presented. Antennae with 11 antennomeres, antennal club dark brown with three antennomeres (Fig. 3). Pronotum finely punctate like head with long black erected pubescence. Scutellum triangular finely punctate as pronotum, with short black pubescence. Elytra finely punctate; cuticle unicolorous, dark brown to black; pubescence black, long, erect. Apex of each elytron with long blackish pubescence. Legs brown with black pubescence. Meso-metasternum with short black pubescence. Abdominal sternites with long black pubescence. Genitalia not visible.
Paratype. Measurements (mm): TL 1.8 EW 1.1.



Figs 1–3. *Trinodes puetzi* sp. nov.: 1 – habitus dorsal view; 2 – habitus lateral view; 3 – antennal club.

Etymology. Patronymic, dedicated to Andreas Pütz (Eisenhüttenstadt, Germany), a well known specialist of the family Byrrhidae (Coleoptera).
Differential diagnosis. *T. puetzi* sp. nov. is habitually similar to *T. rufescens* Reitter, 1877 and *T. hirtus* (Fabricius, 1781), but clearly differ from both and other described species by the form of antennal club, especially by the relative length and shape of terminal antennomere.
Discussion. According to the keys by Peacock (1978) and Háva (2004), the new species is attributed to the genus *Trinodes* of the tribe Trinodini (Trinodinae), differing by the combination of the following characters: pronotum without carina or furrow, antennae with 11 antennomeres, antennal club with three antennomeres, prosternum with distinct antennal grooves, first visible abdominal sternite ussually with two short oblique lines diverging from inner edges of hind coxae, prosternoum extended as an acuminate process fitting into a deep notch in mesosternum. Nevertheless, the genus *Trinodes* is rather uniform varying in structure of anntenae and male genitalia (Peacock 1978). Newly described species *T. puetzi* sp. nov. is habitually similar to *T. rufescens* and *T. hirtus*, but clearly differ from both and other described species by the form of antennal club, especially by the relative length and shape of terminal antennomere.

The currently described new species was erroneously mentioned by Háva (2003: 52) as *T. rufescens* from the Sibirian amber differs from all so far known species by the unique combination of the previously mentioned characters.

Acknowledgements

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New fossil dermestid beetles (Coleoptera: Dermestidae) from the Baltic amber

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Abstract. New representatives of dermestid beetles are described from the Late Eocene to Early Oligocene inclusions of the Baltic amber, i. e. *Anthrenus* (*Nathrenus*) *ambericus* sp. nov., *Anthrenus* (*Nathrenus*) *groehni* sp. nov., *Globicornis* (? *Hadrotoma*) *ambericus* sp. nov., *Attagenus hoffeinsorum* sp. nov. and *Trogoderma larvalis* sp. nov.

Taxonomy, fossil, new species, Coleoptera, Dermestidae, Tertiary, Eocene, Oligocene, Baltic amber

INTRODUCTION

Family Dermestidae is diverse group of Coleoptera with number of cosmopolitan species comprising about 1200 species in recent fauna (Háva 2003). Fossil record of dermestid beetles is well known especially from Cenozoic era of Baltic and Dominican ambers but also from lacustrine deposits of Europe and North America (Carpenter 1992, Wappler 2003). An attribution of the Late Triassic genera from Queensland (Australia) to the family Dermestidae based on elytra structure are considered as family uncertain assignments (Carpenter 1992).

The present study follows of the preceding papers about fossil Dermestidae from Dominican amber (Háva & Prokop 2004) and Baltic amber (Háva & Prokop 2005). Baltic amber is the world most well-known source of amber dated from Late Eocene to Early Oligocene between 35 to 45 Ma. The Dermestidae from Baltic amber are noticed by Larsson (1978), Spahr (1981), Hieke & Pietrzeniuk (1984) and Háva & Prokop (2004, 2005).

MATERIAL AND METHODS

Material of insect inclusions is preserved in polished pieces of rather transparent amber having protection against weathering and damage by embedding in the synthetic resin (GTS / 2-component resin) or at least covered with lacquer. Standard techniques of observation by stereomicroscope (Olympus SZX 9) and digital photography (Olympus 5060) were used.

Because the size of beetles or their body parts can be useful in species recognition, the following measurements were made: total length (TL) – linear distance from anterior margin of pronotum to apex of elytra, elytral width (EW) – maximal linear transverse distance.

Material examined for this study is housed in the following museums and private collections abbreviated by acronyms:

CGPC – Private collection, Carsten Gröhn, Glinde, Germany;
DEIC – Deutsches Entomologisches Institut im Zentrum für Agrarlandschafts- und Landnutzungsforschung (ZALF) e.V., Müncheberg [former in Eberswalde], Germany;

GPIH – Geologisch-Paläontologisches Institut der Universität Hamburg, Germany;
CHHC – Private collection, Christel & Hans Werner Hoffeins, Hamburg, Germany.
Photographs of the all presently described species are available also on the internet web site (Háva 2004b). The integumental structures are named according to Harris (1979). We follow systematics of Dermestidae proposed by Zhantiev (2000) amended by Háva (2003, 2004a).

SYSTEMATIC PALAEONTOLOGY

Anthrenus (*Nathrenus*) *ambericus* sp. nov.

(Figs 1, 2)

TYPE MATERIAL. **Holotype** (no sexed): Amber inclusion of Baltic amber, Jantarnyj, Sambia, Kaliningrad Region, Russia, bought from amber traders, C 4456. Holotype deposited in (GPIH, type no. 4464). Holotype specimen is provided with a red, printed label with text as follows: "HOLOTYPE, *Anthrenus* (*Nathrenus*)*, ambericus* sp. nov., J. Háva, J. Prokop & A. Herrmann det. 2005".

DESCRIPTION OF THE HOLOTYPE. Measurements (mm): TL 2.1 EW 1.4. Body brown, oval (Fig. 1). Dorsal surface covered by black scales (Fig. 1). Individual scales mostly widest about middle with sides converging to strongly rounding apex. Antennae brown with 11 antennomeres; antennal club brown, compact, with 3 antennomeres, terminal antennomere regularly rounded. Eyes with entire median margin. Frontal median ocellus present. Ventral surface covered only with white scales (Fig. 2). Prosternum only with white scales. Metasternum with only white scales, without a large patch of black scales at lateral margins. Abdominal sternites not bearing larger spots of black scales at antero-lateral margins. Sternites I–IV without one large spot of black scales in the middle. Legs brown with white setation.

DIFFERENTIAL DIAGNOSIS. The new *Anthrenus* species belongs to the subgenus *Nathrenus* Casey, 1900. The subgenus *Nathrenus* differs from other subgenera by the following characters: antennae with 11- antennomeres, eyes with complete median margin. The new species visually similar to the following described new species, but differs from it of the characters mentioned in the following key of dermestid species from Baltic amber.

1(2) dorsal surfaces covered by bicolorous scales; each elytron with small circular patches from yellow scales.................... .... *Anthrenus* (*Nathrenus*) *groehni* sp. nov.
2(1) dorsal surfaces covered by unicolorous scales; each elytron without patches.. .... *Anthrenus* (*Nathrenus*) *ambericus* sp. nov.

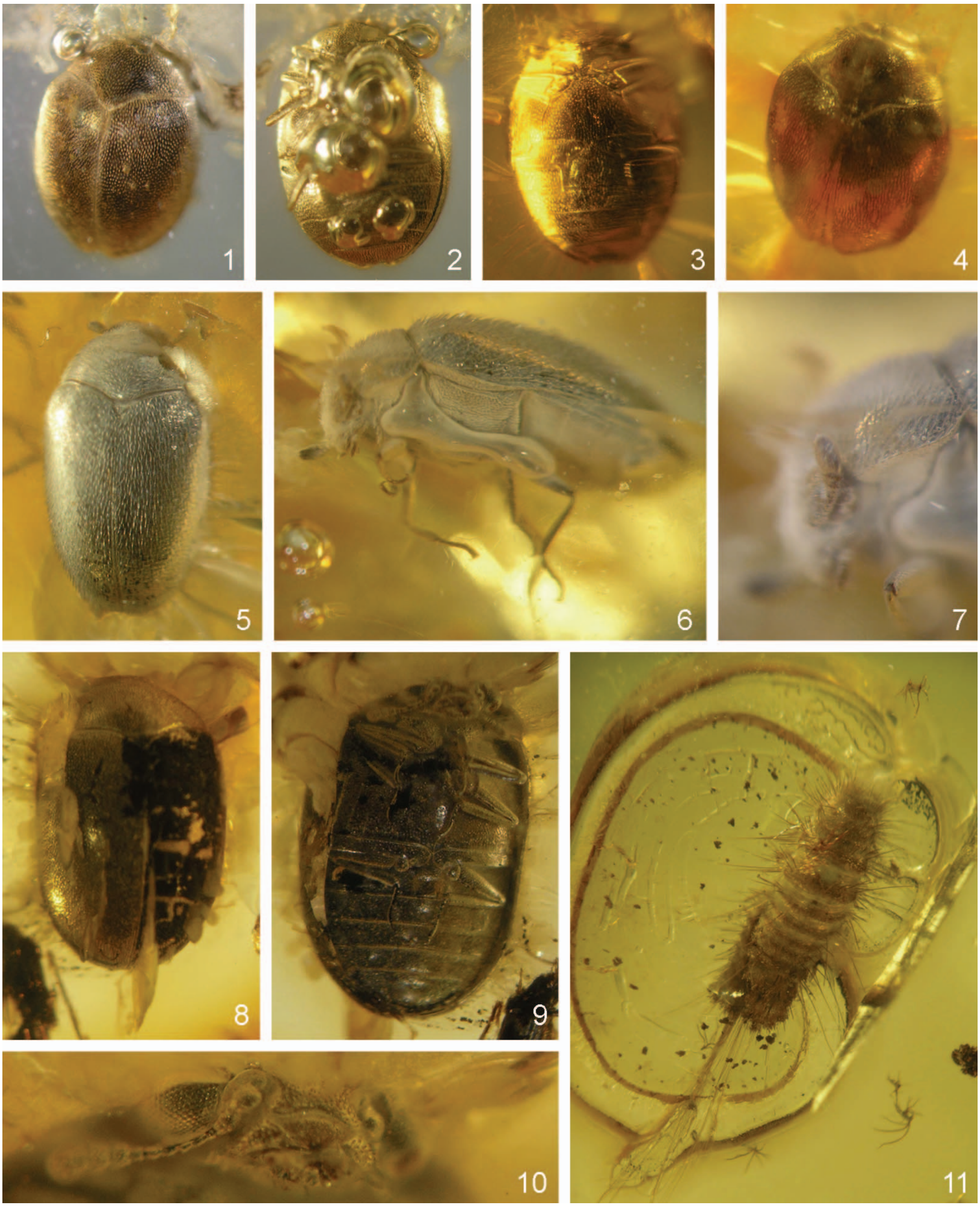
DERIVATIO NOMINIS. The species named after English word amber.

Anthrenus (*Nathrenus*) *groehni* sp. nov.

(Figs 3, 4)

TYPE MATERIAL. **Holotype** (no sexed): Amber inclusion from Baltic amber, Jantarnyj, Sambia, Kaliningrad Region, Russia, bought from amber traders, C 4064. Holotype deposited in GPIH (type no. 4465). Holotype specimen is provided with a red, printed label with text as follows: "HOLOTYPE, *Anthrenus* (*Nathrenus*)*, groehni* sp. nov., J. Háva, J. Prokop &, A. Herrmann det. 2005".

DESCRIPTION OF THE HOLOTYPE. Measurements (mm): TL 1.8 EW 1.2. Body brown, oval (Fig. 3). Dorsal surface covered by black and light scales. Individual scales mostly widest about middle with sides converging to strongly rounding apex. Antennae black with 11 antennomeres; antennal club black, compact with 3 antennomeres, terminal antennomere regularly rounded. Eyes with entire median margin. Frontal median ocellus presented. Each elytron with five small circular spots; spots covered by light scales. Ventral surface covered with unicolorous scales (Fig. 4). Prosternum with unicolorous scales. Metasternum with unicolorous scales, without a large patch at lateral



Figs 1–11. *Anthrenus* (*Nathrenus*) *ambericus* sp. nov. (holotype): 1 – habitus dorsal view; 2 – habitus ventral view; *A.* (*N.*) *groehni* sp. nov. (holotype): 3 – habitus dorsal view; 4 – habitus ventral view; *Globicornis* (? *Hadrotoma*) *ambericus* sp. nov. (holotype): 5 – habitus dorsal view; 6 – habitus latero–ventral view; 7 – head and antennae; *Attagenus hoffeinsorum* sp. nov. (holotype): 8– habitus dorsal view; 9 – habitus ventral view; 10 – head and antennae; *Trogoderma larvalis* sp. nov. (holotype): 11 – habitus dorsal view.

margins. Abdominal sternites not bearing larger spots at antero-lateral margins. Sternites I–IV without one large spot in the middle. Legs black with white setation.

Differential diagnosis. The newly decribed species belongs to the subgenus *Nathrenus* Casey, 1900. The subgenus *Nathrenus* differs from other subgenera by the following characters: antennae with 11 antennomeres, eyes with complete median margin. The habitus of new species visually similar to *Anthrenus ambericus* sp. nov., but differs by structure of antennae, dorsal surfaces covered by bicolorous scales and each elytron with small circular patches from yellow scales.

Derivatio nominis. Patronymic, dedicated to the Carsten Gröhn, Glinde, Germany.

***Globicornis* (? *Hadrotoma*) *ambericus* sp. nov.**

(Figs 5–7)

Type material. **Holotype** (male): Amber inclusion from Baltic amber, Jantarnyj, Sambia, Kaliningrad Region, Russia, bought from amber traders, C 4751. Holotype deposited in GPIH (type no. 4467). Holotype specimen is provided with a red, printed label with text as follows: "HOLOTYPE, *Globicornis (? Hadrotoma) ambericus* sp. nov., J. Háva, J. Prokop &, A. Herrmann det. 2005". In addition amber piece contains one more inclusion with undetermined specimen of Hymenoptera probably from the family Ichneumonidae.

Description of the holotype. Measurements (mm): TL 3.0 EW 1.8. Body black, covered with white long erected setation (Fig. 5). Head black, finely punctate with distinct erected setation. Palpi entirely brown. Frontal median ocellus presented. Antennae with 10 antennomeres, brown, antennal club with 3 antennomeres, terminal antennal antennomere long and oval (Fig. 7). Pronotum finely punctate like head with long white erected setation. Scutellum triangular finely punctate as pronotum, with short white setation. Antennal fossae very superficial. Elytra finely punctate; cuticle unicolorous, black, with white erected long setation. Apex of each elytron with long setation. Ventral surfaces as in (Fig. 6). Prosternum forming a "collar" under which mouthparts fit when head is retracted. Epipleuron reaching of episternum. Mesosternum and metasternum covered with white very short recumbed setation. Metasternum at lateral part near epipleuron with foveate-reticulate punctures. Abdominal sternites finely punctate, covered with white very short recumbed setation. Legs brown, with short setation; antrior tibiae without spines along shaft.

Differential diagnosis. The present newly described species belongs to the genus *Globicornis* Latreille, 1829 according to the number of antennomeres. The genus *Globicornis* attributed within the genera Group I according to the genera keys proposed by Háva (2004). However, the relationship between subgenera *Hadrotoma* Erichson, 1848 and *Globicornis* still remain uncertain, we prefer to attribute our species within subgenus *Hadrotoma* rather than *Globicornis* because of the structure of the terminal antennomeres. Nevertheless, the terminal antennomere of new species is rather suboval against elongated triangular structure typical of *Hadrotoma*. This character could even justify new subgenus, but we propose to attribute it within existing subgenus until supplementary material will be discovered.

Derivatio nominis. The species named after English word amber.

***Attagenus hoffeinsorum* sp. nov.**

(Figs 8–10)

Type material. **Holotype** (probably male): Amber inclusion from Baltic amber, Primorskoje strip mine, Jantarnyj, Sambia Kaliningrad Region, Russia, 888/1, BaB. Holotype deposited in (DEIC). Holotype specimen is provided with a red, printed label with text as follows: "HOLOTYPE, *Attagenus, hoffeinsorum* sp. nov., J. Háva, J. Prokop &, A. Herrmann det. 2005". **Paratypes**: No. 1: (female): Amber inclusion from Baltic amber, Primorskoje in Yantarnyj, Kaliningrad Region, Russia, 888/2, BaB. Paratype deposited in (CHHC). Paratype specimens are provided with a red, printed label with text as follows: "PARATYPE No. 1, *Attagenus, hoffeinsorum* sp. nov., J.

Háva, J. Prokop &, A. Herrmann det. 2005”. No. 2: (female): Amber inclusion from Baltic amber, Jantarny-Kaliningrad, bought from amber traders, C 4458. Paratype deposited in (GPIH, type no. 4468). Paratype specimen are provided with a red, printed label with text as follows: “PARATYPE No. 2, *Attagenus, hoffeinsorum* sp. nov., J. Háva, J. Prokop &, A. Herrmann det. 2005”.

Description of the holotype. Measurements (mm): TL 3.0 EW 1.9. Body black, suboval (Fig. 8). Head black, finely punctate with very short black suberected setation. Palpi entirely brown. Frontal median ocellus presented. Antennae with 11 antennomeres, black, antennal club with 3 antennomeres (Fig. 10). Pronotum black, finely punctate like head with short black suberected setation. Scutellum triangular finely punctate as pronotum, with short black setation. Elytra with unicolorous black cuticle, finely punctate with short subrecumbed setation. Apex of each elytron with very short blackish setation. Legs black with short black setation; tibiae without thorns along shaft. Habitus ventral view (Fig. 9). Prosternum not forming a “collar”, therefore mouthparts free. Prosternal process narrow. Prosternum finely punctate on the disc and foveate on lateral parts. Mesosternum finely punctate as disc of prosternum. Metepisternum foveate punctate, with short black setation. Metasternum finely punctate on the disc and foveate on lateral parts, with short black setation. Abdominal sternites finely punctate, with short subrecumbed black setation.

Variation in paratypes. Paratype No. 1: measurements (mm): TL 2.5 EW 1.3. Paratype No. 2: measurements (mm): TL 2.8 EW 1.8.

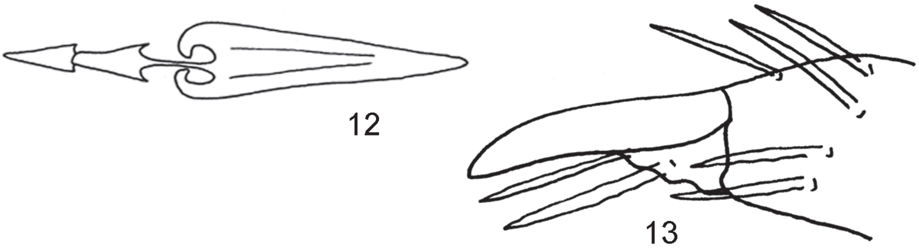
Differential diagnosis. The new Baltic amber species *A. hoffeinsorum* sp. nov. belongs to the genus *Attagenus* (prosternum not forming a “collar”, therefore mouthparts free) and similar to the species *A. dominicanum* Háva & Prokop, 2004 described from Dominican amber, but new species differs by the structure of antennae and form of body.

Derivatio nominis. Patronymic, dedicated to the Christel & Hans Werner Hoffeins, Hamburg, Germany.

Trogoderma larvalis sp. nov.

(Figs 11–13)

Material examined. **Holotype** (larva): Amber inclusion from Baltic amber, Jantarnyj, Sambia, Kaliningrad Region, Russia, bought from amber traders, L 1367. Holotype deposited in GPIH (type no. 4466). Holotype specimen is provided with a red, printed label with text as follows: “HOLOTYPE, *Trogoderma, larvalis* sp. nov., J. Háva, J. Prokop &, A. Herrmann det. 2005”.



Figs 12–13. *Trogoderma larvalis* sp. nov. (holotype): 12 – abdominal hastisetae; 13 – middle left leg.

DESCRIPTION OF THE HOLOTYPE. Measurements (mm) TL 3.8. Cuticle (Fig. 11) yellowish, covered with dense setation; dorsal side with long, yellow, straight or undulating setation, and with short, apically dilated, brown-reddish setation; ventral side with short, light yellow setation. Head hypognathous, strongly sclerotized, with dense yellow setation, which is longer and more delicate anterolaterally. Epicranial sutura present. Coronal suture short, it's frontal parts V-shaped. Ocellus absent. Clypeus not visible. Labrum not visible. Epipharynx not visible. Antennae short, three-segmented, membranose, with sclerotized ring on first and second segment. Mandibles not visible. Maxillae and maxillary palpus not visible. Prementum with rounded fore angles and with many setae in distal part; one pair of this setae exceed labial palpes; postmentum almost quadrangular, somewhat lighter in color than prementum, with many setae of different length. Labial palpes two-segmented.

Prothorax longer than meso- or metathorax, anteriorly and laterally bordered by long setae; anterior, posterior and lateral margins bordered on inner side by hastisetae, which are shorter and darker than other setae. Meso- and metathorax with lateral and central tufts and a transverse row of long setae and with transverse medial, in the middle interrupted band of short, scale-like setae. Mesothorax with one pair of large, oval, annular dorsolateral spiracules. Legs gradually longer from anterior to posterior pair; coxa elongate with long setae; trochanter, femur and tibia with simple, short setae; trochanter triangular; femur wider than but approximately as long as tibia; tarsungulus with two setae – one short and stout and second long and thin (Fig. 13).

Abdomen with eight visible segments. Abdominal tergites 6–8 with dense lateral tufts of dark hastisetae. The hastisetae are longer and more dense on distal segments (Fig. 12). 9th abdominal segment partially immersed in 8th segment, with lateral bands of long, undulate setae. 10th abdominal segment not visible.

DIFFERENTIAL DIAGNOSIS. The described amber larvae belong to the genus *Trogoderma* Dejean, 1821. Larvae of *Trogoderma* differs from other known larvae of the following characters (Beal 1960, Peacock 1993): 1) antenna with antennomere II not more than half as long agin as III; 2) acrotergites with numerous very fine spinulate setae; 3) abdominal tergitesV or VI–VIII with dense lateral tufts of hastisetae; 4) pretarsal setae, on ventral claw, distinclty unequal. From the other known recent larvae belonged to the genus *Trogoderma*, differs the new species of the form and structure of abdominal hastisetae.

DERIVATIO NOMINIS. The species named after larvae, immature stage of insect.

Trinodes puetzi **Háva et Prokop, 2006**

Trinodes puetzi: Háva & Prokop 2006: 278 + figs: 1–3.

MATERIAL EXAMINED (1 male). Amber inclusion from Baltic amber, Primorskoje strip mine, Jantarnyj, Sambia Kaliningrad Region, Russia, 887, BaB, J. Háva det. 2005, deposited in (CHHC).

REMARKS. This species was recently described from the Baltic amber, Jantarnyj, Sambia, Kaliningrad Region, after to two males representing the first known fossil species of this genus (Háva & Prokop 2006).

Acknowledgements

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Contribution to the bionomics of *Dermestes bicolor* (Coleoptera: Dermestidae)

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Abstract. Contribution to the bionomy of *Dermestes bicolor* Fabricius, 1781 collected in the nests of *Ardea cinerea* (Linnaeus, 1758) (Aves: Ciconiiformes) from the southern Moravian region is presented.

Bionomics, Coleoptera, *Dermestes bicolor*, Aves, *Ardea cinerea*, Moravia, Palaearctic region

INTRODUCTION

According to the literature sources dealing with the bionomics of the palaearctic species of the larder beetles (Dermestidae) *Dermestes bicolor* Fabricius, 1781 from the Czech Republic and Central European area, the development of this species has only been described in nests of birds raised by people for economic purposes. It has been found in artificially bred groups of fowls, ducks and pigeons (Hinton 1945, Mroczkowski 1975, Zhantiev 1976, 1998). According to this literature, the larvae live on chicks, they gnaw out tiny wounds into their skin and, after dying of the individual, they feed on its remains.

The species has been recently collected and recorded in towns and villages directly in dovecotes, in bigger towns it has been caught accidentally. For example, several tens of larvae were recorded on young pigeons in southern Bohemia (Písek region) in 2004 (Jan Šrůt pers. comm.). Both adult individuals and larvae were recorded and collected in nesting sites of feral pigeons in lofts (Prague: Staré Město, Nusle, Vinohrady, J. Háva lgt. et coll.).

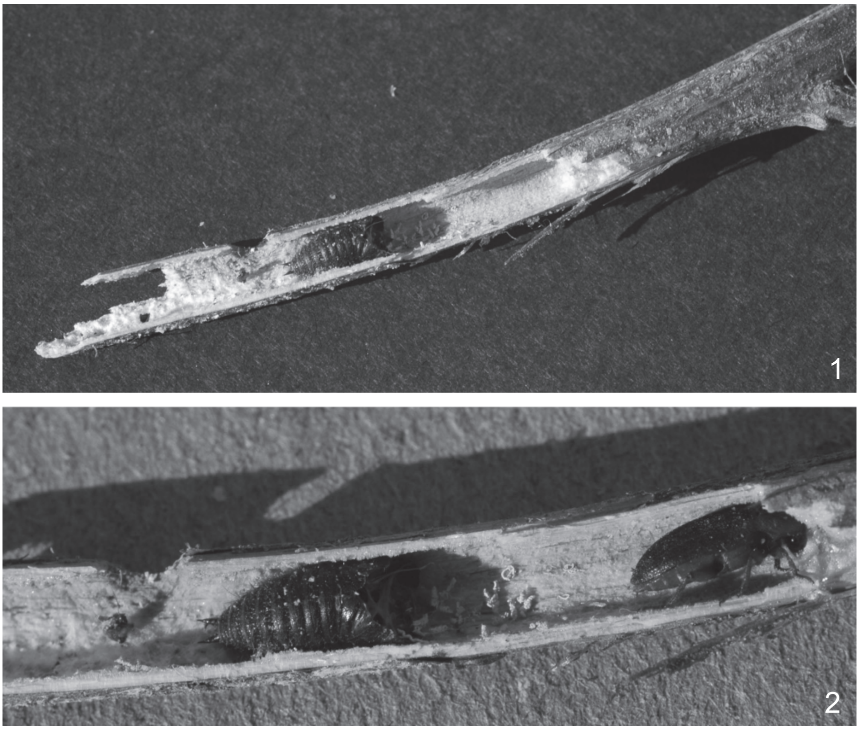
MATERIAL STUDIED

Czech Republic, Moravia mer., Hrabětice, Trávní Dvůr – centre (7264b), 1. iv. 2003, 4 spec., A. Reiter lgt., J. Háva det; Czech Republic, Moravia mer., Hrabětice, Trávní Dvůr (7264b) – fallen nest of *Ardea cinerea*, 16. xii. 2004, 40 spec., A. Reiter lgt., J. Háva det. Specimens are deposited in the collection of the South-Moravian museum in Znojmo and in the private collection of the senior author.

RESULTS AND DISCUSSION

This report gives the information about the first finding of *Dermestes bicolor* in the wild, in the nest colony of the Grey Heron (*Ardea cinerea* Linnaeus, 1758, Ciconiiformes: Ardeidae). This colony is situated about 800 m south-west of Trávní Dvůr settlement (Hrabětice village, Znojmo district, South Moravia) – 7264b grid square, 48° 47’ 26” N, 16° 25’ 28” E, altitude 173 m. It has been known since the 1970s (Martiško 1994) and it has recently reached tens of occupied nests (own observation).

The first individuals of *Dermestes bicolor* were found on the dead body of a bird caught in a tree just above the ground directly under the nest colony on 1 April 2003. In December 2004, two nests fallen probably during the strong wind in November 2004 were collected on the ground under a colony. According to remains of excrements and food of Herons (fish scales, bones, balls of animal hairs), the nests were occupied in 2004. During the research of the nests with the aim to collect commensal beetles, a higher number of wintering adult individuals of *D. bicolor* were found. They were hidden in the galleries bored into wood or thicker stems of plants (probably Apiaceae family) contained in the nests. On the surface of a stick (stem), one round hole with diameter 3.5–4.0 mm followed by a gallery long from 1 to 3 cm is situated. In the gallery, an exuvium of the last larval stage turned with head part inwards can be found. In the end of gallery, an adult individual is usually hidden (Figs 1, 2). Together, 32 living and several dead adult individuals were found in the first nest, 8 living adult individuals, a higher number of dying, incompletely developed individuals and 3 larvae in the second one. It is probable that the total number of individuals in each of the nests was higher because the thicker branches of the nests had been removed during the collection in the field for easier transport of material.



Figs 1, 2. 1 – A stick with an exuvium of the last larval stage. The remain of a bored round hole is obvious in the left upper edge, a chamber, where an adult beetle overwintered, right out of the exuvium (above). 2 – Detail of an exuvium and a chamber with the wintering individual.

We can consequently state that *D. bicolor* in the region of the Czech Republic is not only a pest in farm bird breedings, but is able to develop in nest sites of wild living birds. Nest colonies of communally living bird species can be an original habitat of this beetle in Central Europe. Owing to the bionomy of larvae known from bird breedings, *D. bicolor* can be considered not only to be a commensal species taking advantage of remains in the nests, but also a nest parasite. In the conditions of the Czech Republic, this type of parasitosis has not been till described either in Grey Heron nor in other colonial breeding bird species (Cormorant, White Stork, Night Heron, Greylag Goose, Mallard) (cf. Hudec 1994) and it has not been recorded in our wild living Columbidae (Hudec & Černý 1977). In this connection, it would be interesting to check possible occurrence of *Dermestes bicolor* at other sites of colonially breeding bird species in the wild.

Acknowledgements

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First reliable records of *Sphaerium nucleus* (Mollusca: Bivalvia: Sphaeriidae) in the Czech Republic

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Abstract. First reliable records of *Sphaerium nucleus* (Studer, 1820) from the Czech Republic are presented. The species has been neglected for a long time, because of its conchological similarity to *S. corneum* (Linné, 1758). Notes to the anatomy of both species are added.

Distribution, anatomy, Mollusca, Bivalvia, Sphaeriidae, Palaearctic region

INTRODUCTION

Sphaerium nucleus (Studer, 1820) has long been regarded as a subspecies or infrasubspecific unit of *S. corneum* (Linné, 1758), defined by conchological (more tumid shells with broad umbones) and ecological (preference for temporary habitats) characters. Strong evidence for the distinctness of *S. nucleus*, supported by some newly revised anatomical (type of kidney) and conchological (broad hinge plate, dense porosity) characters, is presented mainly by Korniushin (1994, 1996, 2001). Recently *S. nucleus* has been recognized as a distinct species by many authors, e.g., by Falkner (2000), who also indicates some peculiarities of its biology, namely a relatively long life span of 2–3 years and low juvenile mortality, both probably connected with living in an unpredictable environment.

Sphaerium nucleus or "*Sphaerium corneum* f. *nucleus*" has recently been reported from neighbouring countries (Falkner 2000, Mildner 2000, Piechocki 1989). Authors of the check-list (Falkner et al. 2001) even mention the Czech Republic among the countries with occurrence of this species. However, this was apparently done without revision of any material. The Czech authors referring to "*S. corneum* var. *nucleus*" (e.g., Uličný 1892, Ložek 1956) based their determination on only a few shell characters, where no attention was given to the anatomy. Therefore it is not possible to adapt these records as true *S. nucleus*. In the last 50 years distinction between the species (or subspecies according to the previous system) of the "*Sphaerium corneum* group" has been somewhat omitted and thus no record of *S. nucleus* in the Czech Republic/Czechoslovakia has been made (e.g., Beran 2002).

MATERIAL AND METHODS

In the summer of 2003 and 2004, localities in the Czech Republic with the typical habitats of *S. nucleus* (small more or less stagnant water bodies with dense vegetation) were visited. The numbers of quadrates used in the faunistic grid map are according to the publication of Zelený 1972. The field collections were made using a bowl-shaped sieve. The living animals were observed for a short time (1–2 hrs), then killed and fixed in 70% ethanol or 3% formaldehyde (the specimens preserved in formaldehyde were not suitable for dissections). The dissections were carried out and both anatomical and conchological characters were observed under a stereomicroscope at a magnification 25 or 50 times. For examining the shell characters, the separate valves were put in 5% natrium hypochlorite (as recommended by Araujo & Korniushin 1999) to dissolve the organic layers.

COLLECTION SITES

(Fig. 1)

(1) Water ditch (width at the collection site ca. 1 m, depth 0.5 m) with nearly stagnating water, muddy bottom and edges covered with water plants; approx. 2 km SE of Tvrdonice, S Moravia, CZ-7268, N 48° 44’ 58”; E 17° 00’ 14” [GPS]; 15 specimens examined.
(2) Small drain (width 0.5 m, depth 0.5 m) with slowly running water and muddy bottom, partly covered with water plants; near the pond Kačák, Poodří Protected Landscape Area, ca. 1.5 km SE of Studénka, CZ-6274, N 49° 42’ 23”; E 18° 05’ 15” [GPS]; 15 specimens examined.

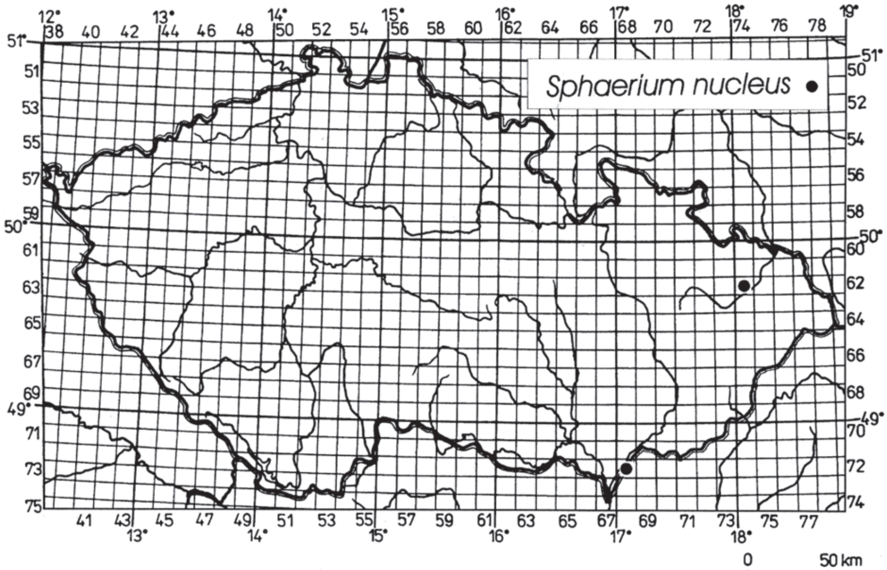


Fig. 1. Localities where *S. nucleus* (Studer) was found.

(3) Small pools (length and width of the largest one ca. 15 and 3 m respectively, max. depth 0.7 m) with dense vegetation cover, Litovelské Pomoraví Protected Landscape Area, near the railway ca. 1.5 km E of Moravičany, CZ-6267, N 49° 45’ 04”; E 16° 59’ 47” [GPS]; 2 specimens examined.

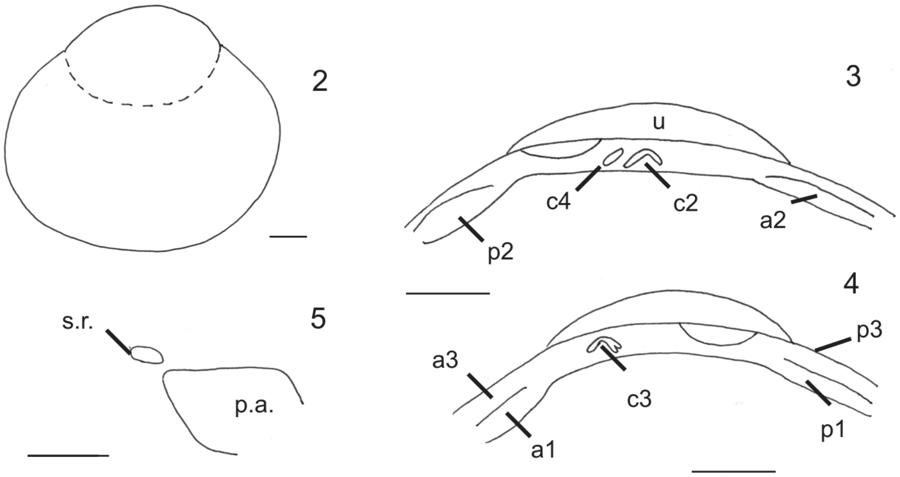
RESULTS

Altogether 32 specimens were examined, and all of them possessed the main characters of *Sphaerium nucleus* (according to Korniushin 1994, 2000): comparatively small shells, nearly oval in outline, with broad umbones and hinge plate, scars of upper siphonal retractors separated from those of posterior adductors, pores in the shell apparently more numerous (although a statistical comparison was impossible due to lack of material) and more evenly distributed than in *S. corneum*, dorsal lobe of nephridium of the closed type. Of the other anatomical structures, attention was paid mainly to the arrangement of the alimentary tract, siphonal muscles and brood pouches. The alimentary tract is not markedly different from that of *S. corneum* (the main characters are the same as those indicated in the literature, e.g., Korniushin & Glaubrecht 2001) – the stomach is stretched in the posterior direction, its transition into the midgut is not marked, major typhlosole (t1) forms two loops in the stomach, minor typhlosole (t2) runs towards the relatively narrow sorting area. The intestine forms a complicated coil with 2 loops. The number of brood pouches per 1 demibranch is up to 5, each containing usually 2–3 embryos or larvae. As in the case of porosity, more material needs to be examined in order to evaluate the intra- and interspecific variability in this character.

DISCUSSION

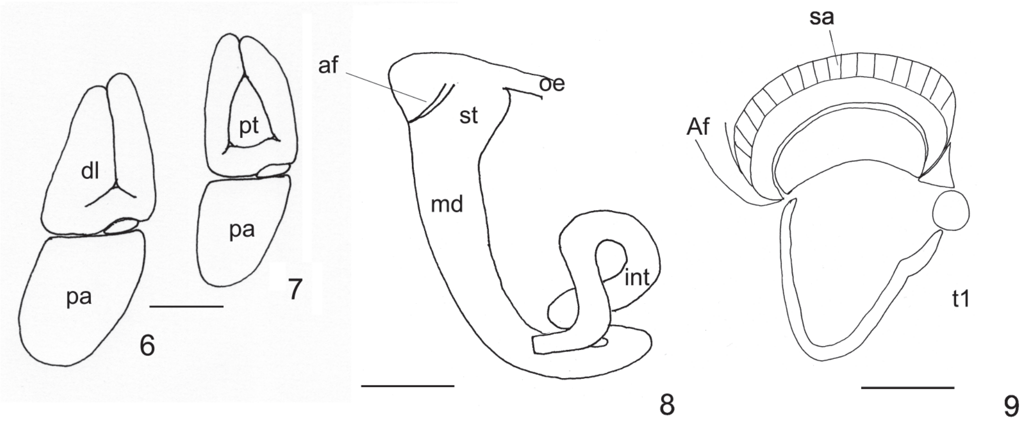
This is the first time *Sphaerium nucleus* is being reported from the Czech Republic as a distinct species and its main characters, previously stated as constant throughout the Palaearctic region, proved to apply to the populations from this country. However, in certain types of biotopes this species could be much more common. There is thus a need to examine all material from swamps, bogs, ditches and other temporary habitats more thoroughly and, possibly, revise older museum collections.

It is also remarkable that both in the Poodří Protected Landscape Area and Tvrdonice *S. nucleus* is found in localities not far from these in which *Anisus vorticulus* (Troschel, 1834) (Horsák 2000, Beran & Horsák 1998), *Pisidium pseudosphaerium* (Favre, 1927) and *Pisidium globulare* (Clessin,



Figs 2–5. *S. nucleus* (Studer). 2 – shell in lateral view; 3 – scars of posterior adductor and siphonal retractor; 4 – detail of hinge plate from left valve; 5 – detail of hinge plate from right valve; u = umbo, c2, c3,c4 = cardinal teeth, a1, a2, a3 = anterior lateral teeth, p1, p2, p3 = posterior lateral teeth, p.a. = scar of posterior adductor, s. r. = scar of siphonal retractor. Scale 1 mm.

1873) (Horsák & Neumanová 2004) were reported. The occurrence of *A. vorticulus* and *S. nucleus* in the same habitats has already been noticed by Falkner (2000). Therefore, the occurrence of those species in the same malacocenoses can be assumed to be a common phenomenon.



Figs 6–9. 6–7 – dorsal lobe of nephridium – *S. nucleus* (Studer). 6 – closed type of nephridium; 7 – *S. corneum* (Linné) – open type; dl = dorsal lobe, pt = pericardial part of the nephridial tubule, pa = posterior adductor. 8–9 – *S. nucleus* 8 part of alimentary tract in lateral view (coil of intestine not in its natural position); 9 inner structure of the stomach; oes = oesophagus, st = stomach, md = midgut, af = anterior fold, sa = sorting area, t1 = major (anterior) typhlosole, int = intestine. Scale 1 mm.

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Ecological study of a high-mountain stream ecosystem (Hincov potok, High Tatra Mountains, Slovakia)

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Abstract. The objective of this study is to describe a high-mountain stream ecosystem, with the main emphasis on particulate organic matter, structure of food guilds and the impact of predation upon macroinvertebrates. In the brook Hincov the concentration of total phosphorus and coarse particulate organic matter (CPOM) increased considerably with the increase in water flow that occurred at spring snow melt; fine organic matter (FPOM) and ultrafine organic matter (UFPOM) peaked in summer. Moss predominated during the cold period, whereas the biomass of periphyton was higher from March to November than in winter. Production of macrozoobenthos peaked in May, when water flow and benthic detritus reached their maximum and water temperature was rising, and dropped during summer. The macroinvertebrate food guilds indicated that this high-mountain stream is a typical autotrophic system. Annual production of macrozoobenthos was very low (2.4 $g \times m^{-2} \times yr^{-1}$ dry weight) and influenced by fish predation. An unusual phenomenon was observed: the production of macrozoobenthos declined due to trout predation despite the increasing temperature of the stream. Macroinvertebrate production in comparable biotopes with no fish was two-times higher. Retention and turnover times of organic matter corresponded to those recorded in a recent study for springs in the same region. In contrast, transport and turnover of organic matter were analogous to the situation in larger streams with high greater flows of water.

High-mountain stream, organic matter, benthos, production, trout predation, stream metabolism, river continuum, Central Europe, Palaearctic region

INTRODUCTION

Running water, because its long shorline is an open aquatic ecosystem, closely associated with terrestrial ecosystems. Vannote et al. (1980) consider running water to be an ancient but flexible system, which rapidly reflects environmental change. Aquatic ecosystems are greatly affected by past geological processes (Thienemann 1950). Current conditions in the high-mountain environment (with the exception of water sources and turbidity) resemble the conditions that prevailed at lower altitudes in Central Europe during the postglacial era. For example, lack of shore vegetation, frozen rivers and soils, temperature and water flow fluctuation and summer floods associated with high turbidity and hydraulic stress (Statzner 1987) prevented the wide-spread distribution of stenoecous species in our region. The role of springs in this system was replaced by shallow unshaded ponds with very unstable daily and annual temperatures (Statzner 1987). Later, the fluctuations, in these decisive abiotic factors decreased. Steffan (1971) and Ward (1994) defined glacier streams as "kryal", characteristically fed by cold, very variable quantitatives glacial meltwater. Kownacka & Kownacki (1972) broadened this concept and included high-mountain streams resulting from the meltwater of permanent snowfields. In addition, Ward (1994) described rhithral stream segments in alpine catchments, which were characterised by soft water, an extended period of snowmelt runoff and a broader temperature range compared to kryal and krenal biotopes. Moss, macroalgae, diatoms, turbellaria, oligochaetes, mayflies, stoneflies, caddisflies and flies make up the benthic communities of these streams. In the present hydrobiological study, the focus was on high-mountain streams – the epirhithral. Many investigations and studies of flowing water are ecosystem based (Fisher & Likens 1973, Anderson & Sedell 1979, Newbold et al. 1982, Minshall et al. 1985, Benke et al. 1988, Šporka & Krno 2003). Central to all of these studies is the fact that the bioenergetics of organisms in flowing waters is affected primarily by certain abiotic factors, such as temperature, discharge, substratum, nutrients and pH. Of the biotic factors, size of individual organisms, duration of development, food quality and quantity, and the mode of feeding are also important. If the primary production of periphytic algae is affected by nutrients and light, then the secondary production of macrozoobenthos depends mainly on the stability of the substratum, temperature and food supply. High-mountain ecosystems are controlled by abiotic rather than biotic factors (Reice 1985). In general terms, when assessing the ecological integrity of a stream, the biological and physical elements, and processes need to be evaluated (Covich et al. 1998, Buffagni & Comin 2000). Measures of ecological integrity should be based on population, community and ecosystem responses to disturbance. Functional measures are usually employed at the ecosystem level: e.g., energy flow, nutrient cycling, primary and secondary production.

The main aim of this study is to highlight the energy budget of a high-mountain stream ecosystem, With particular emphasis on a effect on the secondary production of invertebrates, fish predation, and stream metabolism.

STUDY AREA

The sampling site area, a 50 m length of the brook "Hincov potok" situated in the sub-alpine zone of the High Tatra Mountains (49° 09' 17" N, 20° 04' 45" E), 1480 m above sea level. It forms a part of the catchment of the River Poprad. The drainage basin is granite. The stream is fringed with scrub-pine trees and experiences permanent torrential water flows. The site is subjected to long period of snow cover (five moths), low temperatures and rapid changes in discharge (Fig. 1). The bottom of the brook consists mainly of boulders and stones (68%), with the remainder consisting of gravel and sand. The bottom of the brook surface area is 1.9-times larger than that the water. Approximately 10% of the bottom is covered by moss.

MATERIAL AND METHODS

Physiographical characteristics of the location are used by Plats et al. (1983). 3–4 transects across the brook, with a distance of 15 m between each, were recorded width of the stream, and depth and velocity (using a hydrometric wing) at 1/5,2/5, 3/5, 4/5 of the width. These values were used to estimate the approximate flow and speed of the current. At 30 cm intervals along each transect the dominant substratum, occurrence of macrophytes and filamentous algae were determined.

Field sampling

CPOM, wood, together with macrozoobenthos, was sampled from September 1996 to August 1997, using a cylindrical bottom sampler (area 0.07 m^2). Monthly samples were taken from different mesohabitats: three to four samples from rocks, boulders and moss on boulders, and two to three together from gravel and sand, with the exception of January – February when the creek was completely covered with ice. Samples were preserved in 10% formaldehyde.

FPOM and UFPOM were collected by inserting a sharply pointed tube (area 0.006 m^2) 10–15 cm into the substratum. The material inside the cylindrical bottom sampler was raked out and mixed with hand of water from which a subsample of 0.5 litre was taken. This procedure was repeated several times for both stony and sandy mesohabits. The same sampler was used for micro- and meiozoobenthos. Samples were taken from four different substrata – rocks, fine gravel, detritus, and moss in pools, and in riffles. The samples were transported in isothermic bottles (volume 0.5 l) live to the laboratory .

Plant material (periphyton) adhering to 7–10 stones was removed with a nylon brush and the surface area of the stones measured with aluminium foil according to the method described in Punčochář (1986). To assess amount transported organic matter (TOM), samples of 2–3 litres were collected from the stream . Particulate organic matter (POM) was separated by passing the samples through nested series of sieves (1.0 mm, 50 μm) and

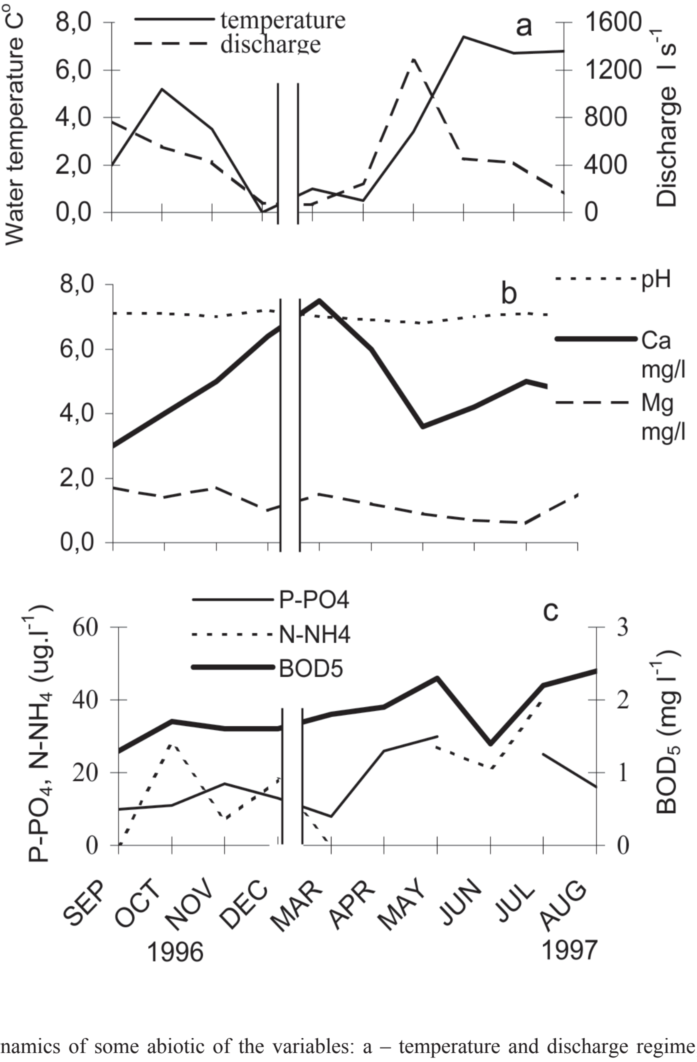

Fig. 1. Seasonal dynamics of some abiotic of the variables: a – temperature and discharge regime; b – Ca, Mg and pH; c – PO_4, NH_4 and BOD_5.

Table 1. Abiotic and biotic characteristics of the brook Hincov; * – min to max

characteristics	annual mean	±SD	characteristics	annual mean	±SD
water temperature (^{o}C)	3.7	2.8	dissoluble substances (mg dm^{-3})	25.4	8.5
current velocity (cm s^{-1})	88.4	49.7	$P\text{-}PO_4$ (mg dm^{-3})	17.3	7.9
discharge (dm^3 s^{-1})	466.6	380.6	$N\text{-}NO_3$ (mg dm^{-3})	549.0	153.5
PH	7.0	6.9–7.2*	$N\text{-}NH_4$ (mg dm^{-3})	17.6	14.4
O_2 (mg dm^{-3})	11.3	0.5	Ca (mg dm^{-3})	4.9	1.4
O_2 saturation (%)	86.0	7.1	Mg (mg dm^{-3})	1.2	0.4
BOD_5(mg dm^{-3})	1.8	0.4	Conductivity (mS cm^{-1})	32	4

finally through 1.0 µm glassfibre filters (Whatman GF/C). Material trapped by the sieves and filters consisted of coarse, fine and ultrafine particulate organic matter respectively. Wet biomass was recalculated as Dry Matter (DM) and Ash Free Dry Matter (AFDM), respectively. POM and periphyton were recorded in terms of AFDM. The surface area of gravel, pebbles, and boulders randomly collected of each sampling site (50 pieces) were measured using aluminium foil (Punčochář 1986).

Algae for the qualitative analysis were collected from several rocks of the sample site, which had a visible growth of algae. Diatoms were removed from stones (about 10 stones) using a toothbrush, and washed directly from the surface of the stones into a sample bottle. Then the sample was preserved by adding a 4% final solution of formaldehyde . Diatoms were identified by examining permanent slides of them prepared by the hot hydrogen peroxide method (Hindák et al. 1975) and mounted in Naphrax. Epilithic diatoms in the qualitative samples were studied and a list of species, identified according to Krammer & Lange-Bertalot (1986, 1988, 1991a, b) is presented.

Samples from epilithon for measuring of the amount of chlorophyll-a were removed using a toothbrush from the entire surface of 5 rocks within a $1m^2$ area, and then processed by the ISO method (using ethanol) for measuring of chlorophyll-a ($mg \times m^{-2}$). The surface area of the rocks was calculated using the same method as for the periphyton samples.

Fish were sampling in August 1997 by electrofishing, using a ZB6 apparatus (150–300 V), (Producer: R. Bednář, Czech Republic). The apparatus was not adjusted for low water conductivity, and thus it was difficult to catch all the fish attached by the current. Therefore, it is assumed, that fish abundance is slightly underestimated. We estimated the total abundance according to Kirka (1968) and the age of the fish from their scales.

Water for chemical analyses was collected from the brook using polyethylene bottles previously washed with hot water and rinsed with distilled water. Samples were stored in the dark at 4°C and analysed within two days of collection.

Laboratory analyses

CHEMICAL ANALYSES. The concentration of ammonia – nitrogen ($N\text{-}NH_4$) was determined colorimetrically with Nessler reagent after distillation. Nitrate - nitrogen ($N\text{-}NO_3$) and phosphate – phosphorus ($P\text{-}PO_4$) were determined according to Hrbáček (1972). Ca and Mg were determined by titration complexometrically. Conductivity was measured at 25 °C.

MICROZOOBENTHOS. Samples of the microzoobenthos and meiozoobenthos were processed *in vivo* immediately after arrival in the laboratory i.e., within 18 hrs of collection, in a drop not covered by coverglass. Identification was performed under a light microscope using common vital dyes. Disputable species were isolated, fixed and stained with protargol according the method of Wilbert (1975). Taxonomic identification was accomplished using keys of Foissner et al. 1991, 1992, 1994, 1995, Song & Wilbert 1989, Kahl 1930–1935), and other available publications.

Live samples for quantitative evaluation were collected with a micro-pipette (volume 20 µl) with trimmed tip from 50 spot sites of taken sample. All the ciliated protozoa collected by this method (and quantitatively other constituents of the micro- and meiozoobenthos) were identified and counted.

MACROZOOBENTHOS. The preserved material was sorted and the animals identified under a stereomicroscope (10-times magnification). Turbellaria were identified according to Hrabě (1954), Oligochaeta according to Hrabě (1981) and Sperber (1950) and Hirudinea according to Hrabě (1954). Mayflies were identified according to Bauernfeind (2001), stoneflies according to Raušer (1980) and Lillehammer (1988), caddisflies according to Waringer & Graf (1997), blackflies (Simuliidae) according to Knoz (1965, 1980) but the nomenclature follows Crosskey & Howard (1997), midges (Chironomidae) according to Wiederholm et al. (1983, 1986), and Bitušík

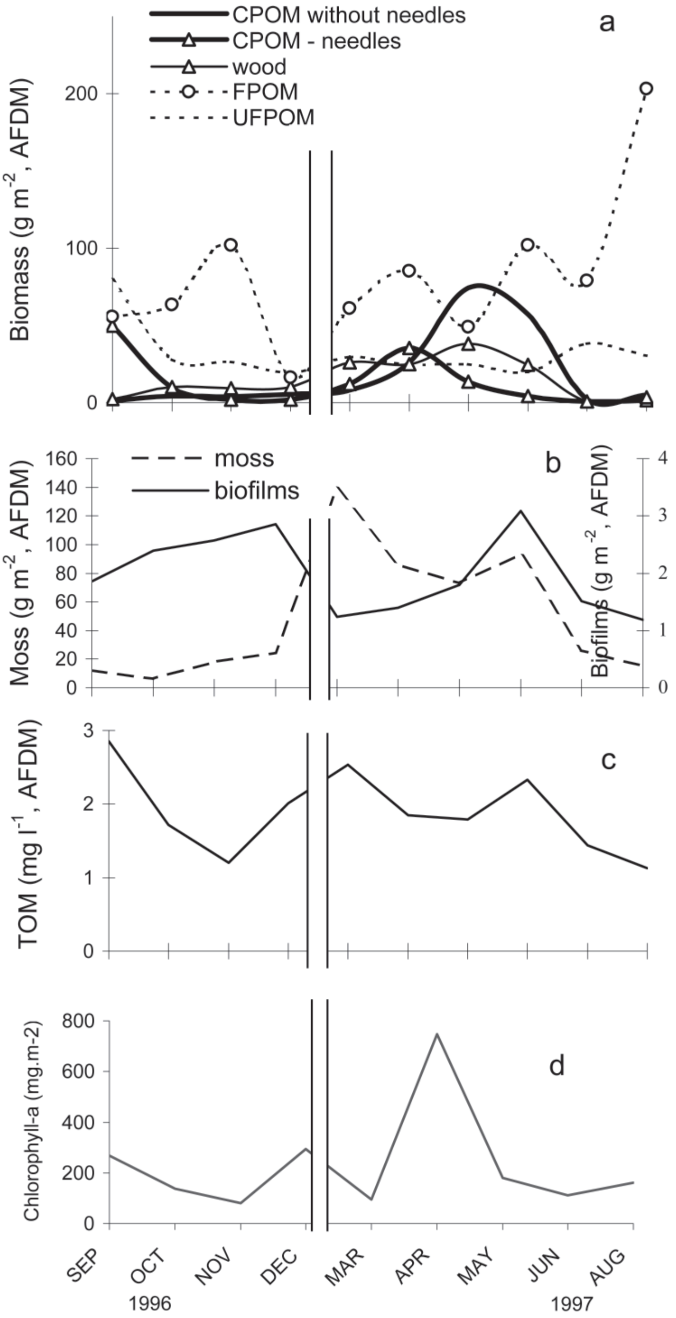

Fig. 2. Seasonal dynamics of some biotic variables: a – benthic organic matter, b – periphyton, c – transport organic matter; d – chlorophlyll-a concentration.

Table 2. Annual budget of the high-mountain stream ecosystem; * – annual mean biomass, ** – annual mean biomass on the bottom of the surface below 1 m^2 of water-surface, according to Punčochář (1986), [a] – annual P/B ratio of macrozoobenthos according to Statzner (1987)

organic matter AFDM		macrozoobenthos (mg.m^{-2} DW)			
input of CPOM (gm^{-2})	181.80		annual production /	mean biomass	annual P/B ratio
input of FPOM+UFPOM (g m^{-2})	540.70	Turbellaria	8.2	2.1	4.0
TOM (g m^{-3})*	1.90	Oligochaeta	49.8	24.9	2.0
TAM (g m^{-3})*	0.01	Ephemeroptera	732.4	164.5	4.5
periphyton (g m^{-2})**	3.80	Plecoptera	980.4	167.9	5.6
macrophytes (g m^{-2})*	47.67	Coleoptera	2.0	1.5	1.3
stream dynamics of POM		**Trichoptera**	323.8	115.1	2.8
retention	496.00	Chironomidae	93.0	6.1	14.9
rate of downstream movement (km d^{-1})	0.05	Simuliidae	180.0	16.5	10.8
turnover length (km)	81.80	other Diptera	46.9	13.2	3.6
turnover time (yr^{-1})	3.09	macrozoobenthos	2416.5	511.8	4.7
annual production and P/B ratio of the food guilds in the macrozoobenthos (g.m^{-2}AFDM)					
shredders	0.25	predators		0.82	
gathering collectors	0.21	macrozoobenthos		2.30	
filter feeders	0.16	annual P/B ratio[a]		4.20	
scrapers	0.86				

(2000), the others flies were identified according to Wagner (1978), Rozkošný (1980) and Nilsson (1997). Population densities, biomass and production were calculated per bottom surface below 1 m^2 of water surface. Biomass was evaluated as wet weight – either directly (formaldehyde weight) or by using length-size relationships (Smock 1980). Wet biomass was recalculated as DM and AFDM according to Waters (1977). Secondary annual production of macrozoobenthos (in DM) was evaluated using size-frequency analysis (Hamilton 1969, Menzie 1980). The seasonal trend in the daily production of macrozoobenthos was evaluated by the method of Zelinka (Zelinka & Marvan 1976).

For calculating the annual stream metabolism we made use of Webster´s equations (1983) describing the velocity of microbial breakdown of POM and its dependence upon temperature, organic spiralling in the stream (Newbold et al. 1982), feeding activity of detrivores (macroinvetebrates) (Petersen al., 1989), retention capacity, rate of downstream movement, recycling rate, turnover length and turnover time of POM according to Naiman et al. (1987).

ABBREVIATIONS

DM – dry matter; AFDM – ash free dry matter; CPOM – coarse particulate organic matter (CPOM> 1mm) (leaves and needles and their fragments); Wood – wooden fraction of CPOM debris; FPOM – fine particulate organic matter (1mm> FPOM >0.05mm); UFPOM – ultra fine particulate organic matter (0.05mm> UFPOM> 0.5µm); POM – particle organic matter (CPOM+FPOM+UFPOM); TIM – transported inorganic matter; TOM – transported organic matter; RCC – river continuum concept.

RESULTS

During the study period high discharge (Fig. 1) from the Hincov potok catchment occurred in late spring (May) and was not accompanied by high turbidity (Fig. 2c). Large and deep Tatra lakes, such as Lake Hincovo and the •abie Lakes, are the main source of water for Hincov potok. With the exception of summer, the discharge (Fig. 1a) from Hincov potok shows the same pattern as temperature. The creek is covered with ice from mid-December to mid-April. Summer temperatures do not exceed 7.5°C. Hincov brook flows through the dwarf pine zone and therefore is shaded. Water is well oxygenated throughout the year. During the spring snowmelt the amount of phosphorus increases (Fig. 1c) (Kopáček et al. 1996).

The amount of CPOM and wood increased markedly with the increase in discharge in spring (Fig. 2a), unlike FPOM and UFPOM, which peaked in summer and were at a minimum during periods of high discharge (May) and when initially covered by ice (December). TOM was more or less constant throughout the year (Fig. 2c) and values of TIM on all dates were negligible (>0.1 mg). Moss (*Fontinalis antipyretica*) predominated during the cold period and in June (Fig. 2b), unlike the periphyton, which was most abundantduring the growing period from March to November. The spring increase in periphyton was associated with decreasing ice-cover (more light) and an increasing amount of phosphorus (Fig. 1c). The autumn increase in periphyton was probably associated with stabilisation of the bottom during the period of low discharge. Th*e* maximum amount of chlorophyll-*a* in the periphyton (Fig. 2d) occurred in April, the minimum in November.

In the algal communities (Table 3) epilithic diatoms predominated, throughout the year. In total, 58 taxa of diatoms were identified. Among the diatoms *Achnanthes minutissima* var. *minutissima*, *A. flexella, A. lanceolata*, *Ceratoneis arcus*, *Cocconeis placentula*, *Cymbella sinuata*, *Diatoma hyemalis*, *D. mesodon*, *Fragilaria capucina*, *Gomphonema clavatum*, *G. olivaceum* and *Meridion circulare* were dominant throughout the year. Two species of diatoms *Amphora inariensis* and *Eunotia parallela* were found in Slovakia for the first time. Filaments of *Draparnaldia glomerata* (Chlorophyceae, Ulotrichales), *Hydrurus foetidus* (Chryso-phyceae, Chrysocapsales) and *Homoeothrix janthina* (Cyanophyceae, Osillatoriales) formed another important part of the algal community. During the cold period (October to December), *Hydrurus foetidus* formed macroscopic slimy colonies attached to rocks and stones.

Microzoobenthos and meiozoobenthos made up an important part of the benthic community and periphyton. Mastigophora, Sarcodina, Ciliophora, Rotifera, Nematoda, Gastrotricha, Tardigrada and rarely also Turbellariomorpha were found in these substrata.. All components occurred regularly without conspicuous fluctuations in abundance. Of the metazoa, Rotifera and Nematoda predominated (100 individuals × ml^{-1} maximum). Protozoa (Table 4), were represented predominantly by Ciliophora. Mastigophora were not so abundant (200 individuals × ml^{-1} maximum), which suggests a oligotrophic status of this stream. In total, 60 taxa of ciliated protozoa were identified.

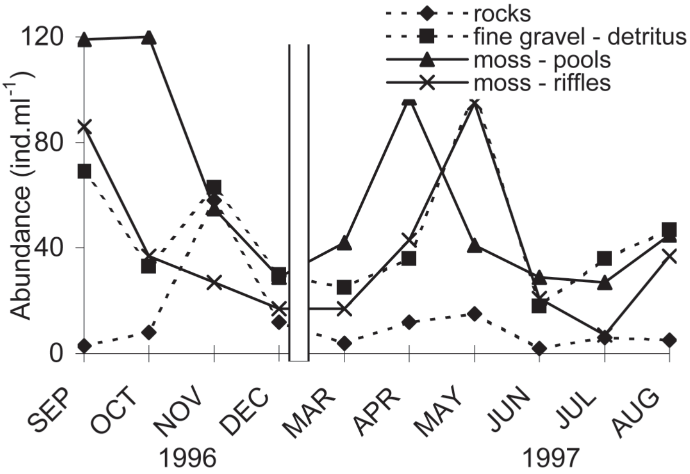

Fig. 3. Seasonal dynamics of Ciliophora in different substrata.

Table 3. Bacillariophyceae of the brook Hincov ; Explanation: * – first record for the fauna of Slovakia

taxon	9.96	10.96	11.96	12.96	3.97	4.97	5.97	6.97	7.97	8.97
Achnanthes biasolettiana Grunow								+		
Achnanthes flexella (Kütz.) Brun	+	+	+	+	+	+	+	+	+	
Achnanthes helvetica (Hust.) Lange-Bert.			+			+		+		+
Achnanthes lanceolata (Bréb. ex Kütz.) Grunow	+	+	+	+	+	+	+	+	+	+
Achnanthes lapidosa Krasske	+							+	+	+
Achnanthes levanderi Hust.						+				
Achnanthes minutissima Kütz.	+	+	+	+	+	+	+	+	+	+
Achnanthes subatomoides (Hust.) Lange-Bert.						+				
Achnanthes sp.								+		
Amphora fogediana Krammer	+				+				+	+
Amphora inariensis Krammer*								+	+	
Amphora pediculus (Kütz.) Grunow				+	+	+	+		+	+
Amphora sp.		+	+							
Anomoeoneis vitraea (Grunow) R. Ross								+		
Cocconeis neodiminuta Krammer									+	
Cocconeis placentula Ehrenb.	+	+		+	+	+	+	+	+	+
Cocconeis placentula var. *euglypta* (Ehrenb.) Cleve						+				
Cocconeis placentula var. *lineata* (Ehrenb.) Van Heurck				+						
Cocconeis sp.				+						
Cyclotella meneghiniana Kütz.		+								
Cyclotella sp.										+
Cymbella minuta Hilse	+	+	+	+	+	+		+	+	+
Cymbella silesiaca Bleisch			+	+	+			+		
Cymbella sinuata W. Greg.	+		+	+	+	+	+	+	+	+
Denticula tenuis Kütz.					+	+	+		+	+
Diatoma hyemalis (Roth) Heib.	+	+	+	+	+		+			
Diatoma mesodon (Ehrenb.) Kütz.	+			+	+	+		+	+	+
Diploneis subovalis Cleve									+	
Eunotia bilunaris (Ehrenb.) Mills	+				+					
Eunotia parallela Ehrenb.*									+	
Eunotia praerupta Ehrenb.							+			
Eunotia sp.			+	+	+					
Fragilaria arcus Ehrenb. Cleve	+	+	+	+	+	+	+	+	+	+
Fragilaria capucina Desm.			+		+		+	+	+	+
Fragilaria capucina var. *rumpens* (Kütz.) Lange-Bert.	+	+								
Fragilaria virescens Ralfs			+							
Fragilaria pinnata Ehrenb.					+					
Fragilaria ulna (Nitzsch) Lange-Bert.		+		+						
Gomphonema angustum C. Agardh	+	+								
Gomphonema clavatum Ehrenb.	+	+	+	+	+	+	+	+	+	+
Gomphonema olivaceum (Hornem.) Bréb.	+	+	+			+			+	+
Gomphonema parvulum (Kütz.) Kütz.							+		+	
Melosira varians C. Agardh		+								
Meridion circulare (Grev.) C. Agardh		+			+	+	+	+	+	+
Navicula angusta Grunow									+	
Navicula cryptocephala Kütz.							+			
Navicula gallica var. *perpusilla* (Grunow) Lange-Bert.				+			+	+	+	
Navicula pupula Kütz.							+			
Navicula sp.				+	+					
Nitzschia acidoclinata Lange-Bert.						+				

Table 3. continued

taxon	9.96	10.96	11.96	12.96	3.97	4.97	5.97	6.97	7.97	8.97
Nitzschia dissipata (Kütz.) Grunow										+
Nitzschia linearis (C. Agardh) W. Sm.	+									
Nitzschia palea (Kütz.) W. Sm.					+					
Nitzschia sp.				+				+		+
Pinnularia microstauron (Ehrenb.) Cleve							+			
Pinnularia subcapitata W. Greg.									+	
Pinnularia viridis (Nitzsch) Ehrenb.							+			
Stauroneis anceps Ehrenb.										+

Small euryecous species, such as *Aspidisca lynceus*, *Cinetochilum margaritaceum*, *Glaucoma scintillans*, as well as *Lithonotus alpestris* and *Loxophyllum meleagris* prevailed among the Infusoria. The seasonal dynamics of Infusoria was apparently strongly dependent on the type of substratum. They were most abundant, however, in all substrata in spring (April–May; Fig. 3) and autumn (September–November), with a shift of one month, depending on the type of substratum and water discharge regime. Abundance of Infusoria was relatively low and only very rarely exceeded 100 individuals. ml^{-1}. Abundance exceeded 100 individuals. ml^{-1} only in moss in riffles and was associated with degradation of autochthonous material during autumn. The low abundance observed was consistent with that expected in mountain oligotrophic streams.

Among the shredders in the macrozoobenthos (Table 5), *Protonemura nimborum* (Plecoptera) and *Potamophylax cingulatus* (Trichoptera) prevailed; gathering collectors were represented mainly by *Stylodrilus heringianus*, *Cognettia sphagnetorum* (Oligochaeta), *Leuctra armata*, *L. autumnalis* (Plecoptera), *Micropsectra* sp., and *Berdeniella unispinosa* (Diptera); scrapers mainly by *Rhithrogena loyolea*, *Baetis alpinus* (Ephemeroptera), *Tvetenia bavarica* gr. and *Eukiefferiella gracei* gr. (Diptera); filter feeders by *Prosimulium rufipes*, *Simulium monticola*, *S. maximum* (Diptera), *Philopotamus ludificatus* and *Drusus discolor* (Trichoptera); and predators by *Crenobia alpina* (Turbellaria), *Diura bicaudata*, *Perlodes intricatus*, *Isoperla sudetica* (Plecoptera), *Rhyacophila tristis* (Trichoptera) and *Dicranota* spp. (Diptera). Stoneflies (Krno 2002) and may-

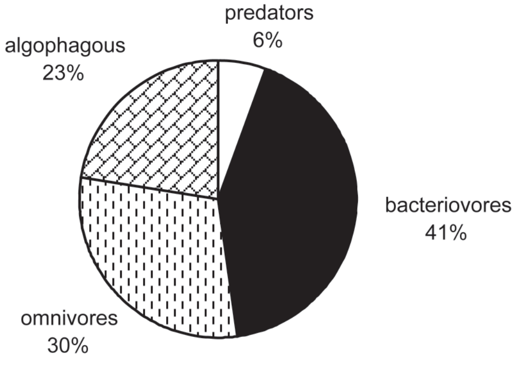

Fig. 4. Food guilds of Ciliophora.

Table 4. Ciliophora of the brook Hincov; + frequency of Ciliophora 0–10%, ++ 11–50%, +++ 51–100%

Aspidisca cicada (Mueller, 1786)	+
Aspidisca lynceus (Mueller, 1773)	+++
Balanonema biceps (Penard, 1922)	+
Blepharisma hyalinum Perty, 1922	+
Bryophyllum tegularum Kahl, 1931	+
Chaenea limicola Lauterborn, 1901	+
Chaenea sp.	+
Chilodonella uncinata (Ehrenberg, 1838)	+
Chilodontopsis sp.	+
Chlamydonella alpestris Foissner, 1979	+
Chlamydonella rostrata (Vuxanovici, 1963)	++
Chlamydonelopsis plurivacuolata Blatterer et Foissner, 1990	+
Cinetochilum margaritaceum (Ehrenberg, 1831)	+++
Coleps hirtus (Mueller, 1786)	+
Colpoda steinii Maupas, 1883	+
Ctedoctema acanthocryptum Stokes, 1884	+
Cyclidium heptatrichum Schewiakoff, 1893	++
Cyrtolophosis elongata (Schewiakoff, 1892)	+
Cyrtolophosis muscicola Stokes, 1885	+
Dexiotricha tranquilla (Kahl, 1926)	+
Frontonia acuminata (Ehrenberg, 1833)	+
Frontonia angusta Kahl, 1931	++
Frontonia atra (Ehrenberg, 1833)	+
Glaucoma scintillans Ehrenberg, 1830	+++
Glaucoma reniformis Schewiakoff, 1893	+
Halteria grandinella (Mueller, 1773)	+
Hemisincirra gellerti (Foissner, 1982)	+
Holophrya discolor Ehrenberg, 1833	+
Holophrya teres (Ehrenberg, 1833)	+
Holosticha monilata Kahl, 1928	++
Holosticha multistillata Kahl, 1928	++
Lacrymaria filiformis Maskel, 1886	++
Lembadion bullinum (Mueller, 1786)	+
Litonotus alpestris Foissner, 1978	+++
Litonotus varsaviensis (Wrzesniowski, 1866)	+
Loxocephalus sp.	+
Loxophyllum helus (Stokes, 1884)	+
Loxophyllum meleagris (Mueller, 1773)	+++
Microthorax pusillus Engelmann, 1862	+
Nassula ornata Ehrenberg, 1833	+
Nassula picta Greeff, 1888	+
Oxytricha chlorelligera Kahl, 1932	+
Oxytricha ferruginea Stein,1859	++
Oxytricha haematoplasma Blatterer et Foissner, 1990	+
Oxytricha setigera Stokes, 1891	+
Oxytricha similis Engelmann, 1862	+
Paracolpidium truncatum (Stokes, 1885)	+
Placus luciae (Kahl, 1926)	+
Platyophrya spumacola Kahl, 1927	+
Platyophrya vorax Kahl, 1926	+
Pseudochilodonopsis fluviatilis Foissner,1988	+
Sathrophilus muscorum (Kahl, 1931)	++
Strobilidium caudatum (Fromentel, 1876)	+
Tachysoma pellionellum (Mueller, 1773)	++
Trachelophyllum apiculatum (Perty, 1852)	+
Trithigmostoma cucullulus (Mueller, 1786)	+
Trithigmostoma srameki Foissner, 1988	++
Trochilia minuta (Roux, 1899)	++
Trochiliopsis opaca Penard, 1922	+
Urosomoida agiliformis Foissner, 1982	+

flies were the most productive. On the other hand, the production of midges was surprisingly low (Table 2). This can be explained by low the temperature, which affects growth and life cycles, limited sources of food, refuges and relatively little cover provided by mosses and epilithic algae on the stony substratum.. The total production of macrozoobenthos peaked in May (Fig. 5) when discharge and benthic detritus were at maximum and there was a considerable increasing of temperature. The peak in Diptera occurred in June. Abiotic parameters were important for the production of filterers and scrapers (Fig. 6b, c). On the other hand, biotic parameters were crucial for shredders and predators (Fig. 6a, e). Total annual production of macrozoobenthos in Hincov potok was only 2.4 $g \times m^{-2} \times yr^{-1}$ dry matter.

We recorded 163 brown trout *Salmo trutta fario* per km in Hincov potok. They were two to three years old and on an average 115 mm long. An earlier estimate (Kirka (1968) were 206 individuals per km.

DISCUSSION

The increased amount of NH_4 in spring and summer indicates some nutrient enrichment in the catchment, though not as high as that recorded by Kownacki (1977) and Bombowna (1997) in Rybí potok (the High Tatra Mts.) during the tourist season. A similar fluctuation in phosphorus and nitrogen (PO_4, NO_3) was also recorded in the Czarny creek (a high mountain stream) in the Polish Tatras (Kownacki et al. 1997).

Seasonal distribution of CPOM (Fig. 2a) differs considerably from seasonal dynamics of detritus in sub-mountain streams flowing through forests (Krno et al. 1996, 1997), where the amount of CPOM and wood increases in autumn (November and December). In Hincov potok CPOM increases after snowmelt and resultant increase in discharge during spring.

The two filamentous autotrophs – *Homoeothrix janthina* and *Hydrurus foetidus* which were numerous in Hincov potok, are characteristic of streams flowing through mountain forests (Kawecka, 1993). The other algae in the creek, mostly diatoms, are also typical of high mountain streams. Most of the species are indicators of high oxygen concentration and are sensitive to organic pollution. The algal communities of other mountain streams in the Tatras are similar (Kawecka 1981, 1982, 1993).

The feeding guilds of Ciliophora present (Fig. 4) suggest an increased proportion of algivorous and omnivorous as opposed to bactivorous species, compared to streams in Slovakia with a oligotrophic status, e.g. the upper sections of the Turiec river (Krno et al. 1997) and Javorník brook (Tirjaková 1997).

In these cases heavy shading of the stream and an increased supply of allochthonous material play a significant role. The increased proportion of algivorous species in Hincov brook is indicative of the original character streams of that flow through landscapes with little or very little tree cover. This observation corresponds with that of other authors e.g. Primc (1988).

Statzner (1987) reports that there are five important factors affecting lotic ecosystems: 1) temperature; 2) discharge and the character of the substratum (affected by the discharge regime), its stability, interactions between the aquatic environment and organisms, atmosphere, hyporheal and turbidity; 3) light; 4) nutrients which affect primary production; and 5) the input of allochtonous organic matter. Climatic, geological and hydrological conditions, tributaries, shore vegetation and geomorphology of the basin (macroenvironmental factors) are reported to control the

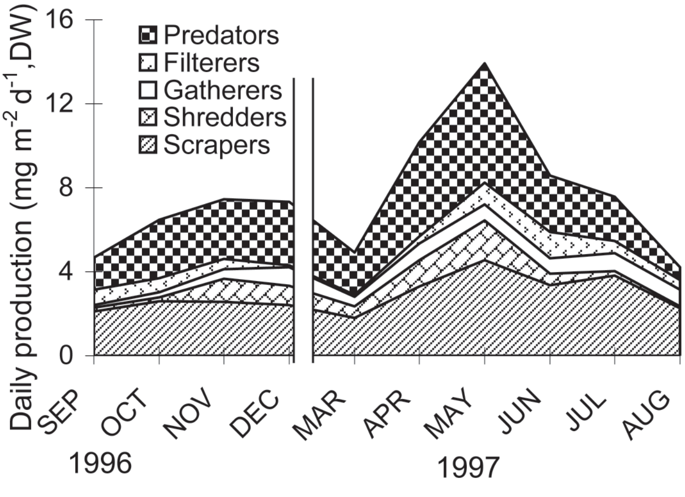

Fig. 5. Seasonal dynamics of of the production of the various guilds in the brook Hincov.

Table 5. Macroinvertebrate of the brook Hincov; sum – sum of individuals

taxon	sum	taxon	sum
Turbellaria		**Trichoptera**	
Crenobia alpina (Dana, 1766)	18	*Rhyacophila glareosa* McLachlan, 1867	2
Oligochaeta		*Rhyacophila obliterata* McLachlan, 1863	9
Nais variabilis Piguet, 1906	4	*Rhyacophila tristis* Pictet, 1834	13
Stylodrilus heringianus (Claparede, 1862)	92	*Rhyacophila vulgaris* Pictet, 1834	2
Trichodrilus tatrensis (Hrabě, 1937)	1	*Wormaldia occipitalis* (Pictet, 1834)	28
Propappus volki Michaelsen, 1916	12	*Drusus annulatus* (Stephens, 1837)	3
Cognettia sphagnetorum (Vejdovsk7, 1877)	22	*Drusus biguttatus* (Pictet, 1834)	14
Cognettia glandulosa (Michaelsen, 1888)	1	*Drusus discolor* (Rambur, 1842)	71
Mesenchytraeus armatus (Levinson, 1883)	3	*Potamophylax cingulatus* (Stephens, 1837)	29
Eiseniella tetraedra tetraedra (Savigny, 1826)	1	*Acrophylax vernalis* Dziedzielewicz,1912	6
Haplotaxis gordioides (Hartmann, 1821)	6	*Halesus rubricollis* (Pictet, 1834)	3
Hirudinea		*Melampophylax nepos* (McLachlan, 1880)	4
Helobdella stagnalis (Linnaeus, 1758)	1	*Chaetopteryx polonica* Dziedzielewicz, 1889	2
Ephemeroptera		**Simuliidae**	
Ameletus inopinatus Eaton, 1887	7	*Prosimulium rufipes* (Meigen, 1830)	127
*Baetis alpinu*s (Pictet, 1843–1845)	561	*Simulium cryophilum* (Rubtsov, 1959)	2
Baetis melanonyx (Pictet, 1845)	4	*Simulium argyreatum* Meigen, 1838	135
Baetis vernus Curtis, 1843	1	*Simulium maximum* (Knoz, 1961)	10
Electrogena lateralis Curtis, 1834	1	*Simulium monticola* Friederichs, 1920	101
Rhithrogena carpatoalpina Klonowska et al., 1984	5	**Chironomidae** *Brillia modesta* (Meigen, 1830)	7
Rhithrogena picteti Sowa, 1971	6	*Eukiefferiella brevicalca*r group	2
Rhithrogena gr *semicolorata*	1	*Eukiefferiella gracei* group	38
Rhithrogena puytoraci Sowa et Degrange, 1988	34	*Orthocladius* (*Eudactylocladius*) sp.	3
Rhithrogena loyolea Navás, 1922	94	*Orthocladius* (s.str.) *frigidus* (Zetterstedt, 1838)	2
Plecoptera		*Orthocladius* (s. str.) sp.	7
Brachyptera starmachi Sowa, 1966	2	*Parakiefferiella* sp.	4
Protonemura auberti Illies, 1954	6	*Parametriocnemus boreoalpinus* Gowin, 1942	1
Protonemura brevistyla (Ris, 1902)	2	*Paratrichocladius* sp.	3
Protonemura montana Kimmins, 1941	65	*Parorthocladius* sp.	2
Protonemura nimborum (Ris, 1902)	155	*Rheocricotopus effusus* (Walker, 1856)	1
Leuctra armata Kempny, 1899	254	*Thienemaniella* Pe 2b Langton, 1991	3
Leuctra autumnalis Aubert, 1948	282	*Tvetenia bavarica* group	37
Leuctra pseudosignifera Aubert, 1954	10	*Micropsectra atrofasciata* group	21
Leuctra pusilla Krno, 1985	43	**Other Diptera**	
Leuctra rosinae Kempny, 1900	1	*Dicranota* spp.	151
Capnia vidua Klapálek, 1904	72	*Eloeophila submarmorata* (Verrall, 1887)	5
Diura bicaudata (Linnaeus, 1758)	18	*Eloeophila* spp.	10
Isoperla sudetica (Kolenati, 1859)	66	*Tricyphona immaculata* (Meigen, 1804)	5
Perlodes intricatus (Pictet, 1841)	13	*Pedicia* (*Crunobia*) *straminea* (Meigen, 1838)	6
Siphonoperla neglecta (Rostock, 1881)	12	*Bazarella subneglecta* (Tonnoir, 1922)	5
Coleoptera		*Berdeniella manicata* (Tonnoir, 1920)	5
Elmis latreille (Bedel, 1878)	8	*Berdeniella unispinosa* (Tonnoir, 1919)	28
Hydraena excisa (Kiesenwetter, 1849)	2	*Berdeniella illiesi* Wagner, 1973	16
Wiedemannia spp.	11	*Liponeura cinerascens minor* Bischoff, 1922	4

character of the river continuum (they affect the input of nutrients, light and accumulation of detritus) (Minshall et al. 1983). Climate and changes in the substratum (local – microenvironmental factors) have a similar impact. Based on the proportional composition of organisms belonging to the various food guilds (Mackay 1987, Krno et al. 1996a), the high mountain Hincov potok can be considered a typical autotrophic ecosystem (Fig. 5, Table 2) in which consumers of primary production prevail over detritivores. The amount of organic matter and water temperature determine

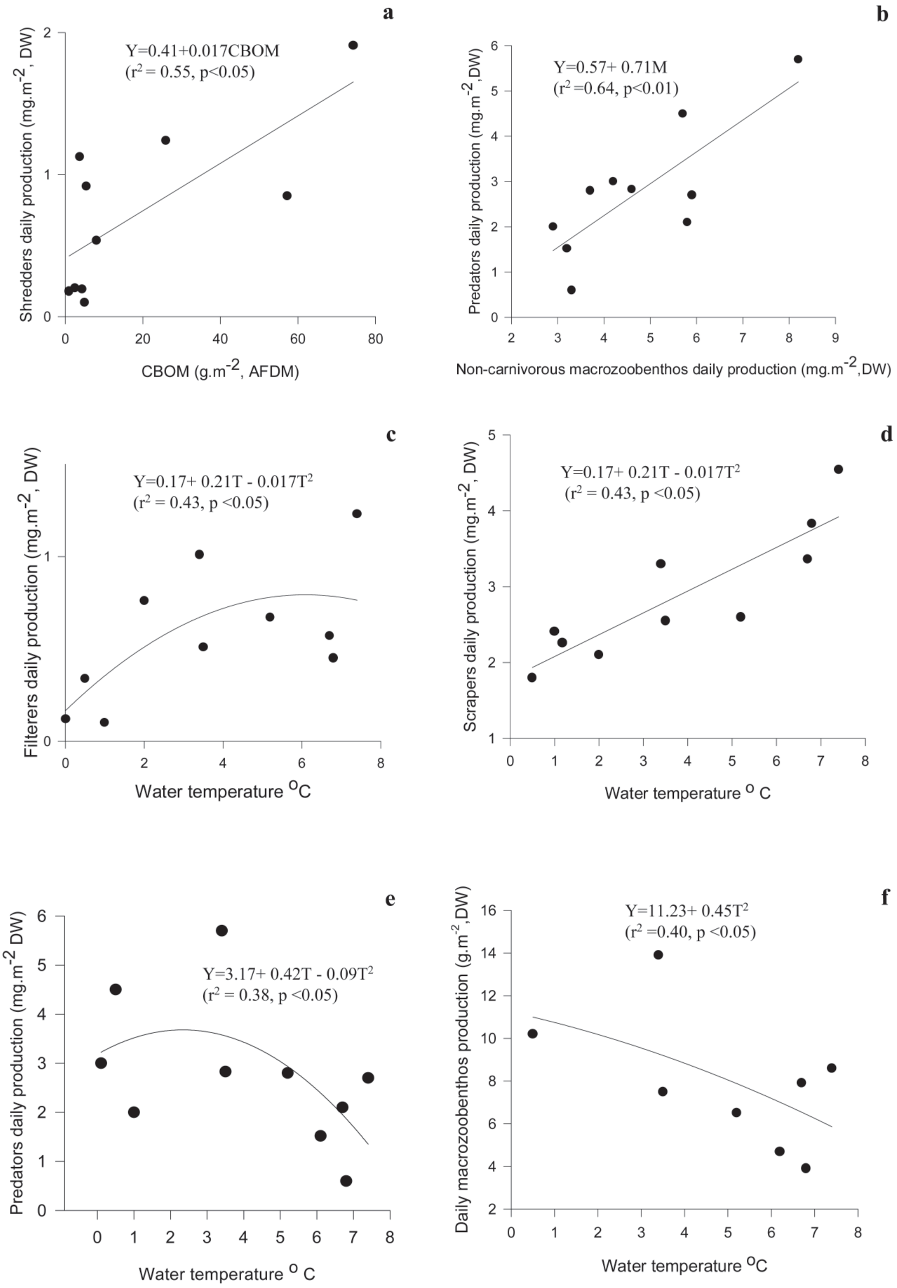

Fig. 6. Relationships between macrozoobenthos production and some environmental variables; CPOM, M – macrozoo-benthos production, T – temperature.

seasonal production of the macrozoobenthos (Fig. 6). In spite of the ultraoligotrophic conditions, high mountain ecosystems situated above the upper timberline (Tables 1 and 2) retain their autotrophic nature. The main food chain of these ecosystems (Fig. 2b), depends on primary producers, which is similar to the conditions that prevail in larger sub-mountain rivers, e.g. Turiec (Krno et al. 1996). To some extent, this crucial deviation of the structure of the macrozoobenthos trophic guilds from the RCC (Vannote et al. 1980) is similar to thattowards autotrophy in streams, as reported by Minshall et al. (1985) for semi-desert areas. The departure from the River Continuum Concept observed in Hincov potok is due to the high exposure of this stream to light, which results from its being above the timberline. According to Peckarska (1983), the impact of abiotic factors predominates in habitats with harsh conditions (homogenous substratum, high fluctuation in current velocity, temperature, depth and width of the stream). For these habitats, a lower input of nutrients (both allochthonous and autochthonous – oligotrophy), lower species diversity, high index of taxa domination, and low number of predators and predominance of trout is characteristic. On the other hand, it is also reported that in such biotopes, A-strategists, characterised as species with a wide ecological niche, long developmental cycle, low fecundity, high mortality in all stages, and low diversity and productivity, are common (Williams & Felmate 1994). A-strategists live in biotopes with predictable and extreme environmental factors, where interspecific competition is weak, and predators and species with a long diapause during embryonic and larval development predominate. A similar situation was found in Hincov potok. In this creek, unlike the springs studied by Krno et al. (1997; also Fig. 5, Table 2), predatory invertebrates are very abundant even in the presence of an abundance of trout . The total production of macroinvertebrates in Hincov potok (2.4 g×m^{-2} dry matter) is much lower than in mountain and sub-mountain (7.3–19.9 g×m^{-2} dry matter) streams, such as those investigated by Šporka & Krno (2003). I addition, in their study a very low production of filter feeders were found (Table 2). According to Benke et al. (1998) this is typical of ultraoligotrophic conditions with extremely low alkalinity. Therefore, production by macrozoobenthos in high-mountain streams is affected by the sum of the mean daily temperatures, altitude and slope. At higher altitudes, production is lower because of low temperatures and hydraulic stress (steep slope).

In comparable Pyrenean biotopes without fish (Lavandier & Décamps 1984), the yearly production of macrozoobenthos is double (4.9–7.0 g×m^{-2} dry matter) that recorded in this study. The ultraoligotrophic biotope studied thus offered an opportunity to observe the impact of trout predation on macrozoobenthos (Allan 1982). Richardson (1993) analysed the data in the literature on the interaction between macroinvertebrates and fish, but did not come to any conclusion. Allan (1982) found that the removal of trout from a river had no significant affect on the prey and offered two explanations . It is likely that his experimental site, a 1220 m section, was too short for such an experiment. Our hypothesis is supported by a phenomenon that is very unusual in high-mountain ecosystems: a decrease in the production of macrozoobenthos (excluding scrapers) with increase in temperature (Fig. 6d), which contrast with what occurs in Pyrenean streams without fish where the production of macrozoobenthos peaked when temperature were highest(Lavandier 1975, 1981, 1982). This may be explained by an increase the voracity of the trout with increase in temperature. Although brown trout is a cold-water fish, its optimum for spawning and development of embryos and larvae is above 5 °C. Cold-water salmonid fish are known to increase their feeding with increasing temperature. Alabaster & Lloyd (1994) and Elliott & Hurley (2000) showed that feeding activity in trout starts at 5 °C and that the daily energy intake increases with increasing water temperature. Maximum growth and gross efficiency in the conversion of energy intake into growth in brown trout occurred at 9.3 °C. At 2–3 °C, trout do not feed or take food only sporadically. There is a relatively high abundance of brown trout in this ultraoligotrophic stream compared to other sub-mountain streams in the Váh River basin (Kirka 1968, Holčík et al. 1976). This is probably because from the fact that the location is close to the mesotrophic Lake Popradské which is well populated with brown trout, partly from hatcheries. The part of Hincov potok studied here is connected with Lake Popradské via Krupá brook. This is probably the reason for the high abundance of brown trout in this part of the creek compared to the River Estibere in Pyrenees (Lavandier & Décamps 1984).

The metabolism, retention, and organic matter turnover time in Hincov potok (Table 2) correspond to those recorded for small streams and springs (Minshall et al. 1992, Krno et al. 1997). In contrast, transport of organic matter and the length of turnover of organic matter are similar to those recorded in larger streams. This is specific for high-mountain streams and is different from the concept of the river continuum, which is more applicable to streams originating in woodland areas (Vannote et al. 1980).

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Hymenophorus evae sp. nov. and *H. gerdae* sp. nov. (Coleoptera: Tenebrionidae: Alleculinae) from Iran

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Abstract. *Hymenophorus evae* sp. nov. and *H. gerdae* sp. nov. from Iran are described, keyed and illustrated. Two new species were compared and keyed with the type material of the species *Hymenophorus indicus* Fairmaire, 1896. *H. evae* sp. nov. differs from *H. indicus* by having holes from both sides of pronotum base near scutellum, punctation of distictly sixangled pronotum of *H. gerdae* sp. nov. sparser, punctation of pronotum of *H. indicus* denser. New distributional data of the species *H. indicus* Fairmaire, 1896 from Iran are added.

Taxonomy, new species, description, distribution, key, Coleoptera, Tenebrionidae, Alleculinae, *Hymenophorus*, Palaearctic region

INTRODUCTION

In the year 1851 Mulsant has decribed new genus *Hymenophorus* with the single species *Hymenophorus doublieri*. In present, over one hundred species of this tenebrionid genus have been described so far (Borchmann 1910, Fall 1931, Campbell 1971). The highest species diversity of the genus is known from the region of north, central and southern America. A few species of this genus are presented also in the Palaearctic region (Mader 1924). *Hymenophorus doublieri* Mulsant, 1851 (= *H. avajewi* Semenov, 1901; = *H. scutellatus* Pic, 1901) is widely distributed in Europe (e. g. Horion 1956, 1957, Mařan 1952, Novák 2005); *H. baudi* Seidlitz, 1896 is known from Cyprus; *H. veterator* Lewis, 1895 from Japan and *H. candeli* Pardo-Alcaide, 1978 is distributed in Morocco. Finally *H. indicus* Fairmaire, 1896 is describe from India.

MATERIAL AND METHODS

Material from Iran (*Hymenophorus gerdae* sp. nov.) was obtained during expedition of National museum (Natural History) of Prague to Iran in 1973, and from the private collectors, mainly from Andrey Plutenko (*Hymenophorus evae* sp. nov.).

Some detail to the localities of the expedition of National Museum (Prague) were published by Hoberlandt (1974, 1981, 1983):

Loc. no. 39: Marg-e Malek (32° 29’ N, 50° 30’ E), 30 km E of Kuhrang (32° 32’ N, 50° 20’ E), 3200 m., Kuhha-ye Zagros (Chain of East Zagros mountains), 1. 7. 1970, Lorestan, West Iran;
Loc. no. 152: 13 km SSE of Nikshahr (26° 08’ N, 60° 11’ E), valley of the river Nikshahr (Rudkhaneh Nikshahr), 8.–9. 4. 1973, Baluchistan, SE Iran;
Loc. no. 186: Deh Bakri (29° 03’ N, 57° 56’ E), Kuh-e Jebal Barez, 1700–1750 m., 30. 4. – 3. 5. 1973, Kerman (province), E Iran;
Loc. no. 187: Mohammadabad (28° 57’ N, 57° 55’ E), 35 km NNW of Sabzevaran (Jirout), 1600 m, on the road between Deh Bakri and Sabzevaran, 3.–5. 5. 1973, Kerman (province), E Iran;
Loc. no. 239: 13 km SSW of Yasuj (30° 34’ N, 51° 32’ E), 1800 m, valley of the Rudkhaneh river, Dasht-e Rum, 12.–13. 6. 1973, E Zagros Mts., Fars, S Iran;

Loc. no. 241: Kuhe Dena (Mts.), SW slope (30° 49' N, 51° 35' E), 5 km NE of Sisakht, 2500–3000 m, 13.–14. 6. 1973, E Zagros, Fars, S Iran;
Loc. no. 245: 29 km E of Yasuj (30° 41' N, 51° 43' E) and 10 km NW of Karun, 2650 m, 16.–17. 6. 1973, E Zagros Mts., Fars, S Iran;
Loc. no. 284: Pol-e Tang, 60 km NW of Andimeshk (32° 51' N, 47° 56' E), on the river Saimareh, 490 m, 10.–11. 4. 1977, Lorestan, SW Iran.

Informations concerning the type material were taken from the locality labels.

Two important quotients were used for description of species of subfamily Alleculinae. "Ocular index" dorsally (Campbell & Marshall 1964) is calculated by measuring the minimum distance between the eyes and dividing this value by the maximum dorsal width across the eyes. The quotient resulting from this division is then converted into an index by multiplying by 100. "Pronotal index" (Campbell 1965) expresses the ratio of the length of the pronotum along the midline to the width at the basal angles. This ratio is multiplied by 100 for convenience in handling.

New species *Hymenophorus evae* sp. nov. and *Hymenophorus gerdae* sp. nov. were compared and keyed with type material of *Hymenophorus indicus* Fairmaire, 1896 (type material was loaning from MNHN Paris).

Specimens of the presently described species are provided with one red printed label: "Hymenophorus evae sp. n. or Hymenophorus gerdae sp. n. HOLOTYPUS or PARATYPUS V. Novák det. 2005".

The following abbreviations are used in the paper:
MNHN – Museum National d'Histoire naturelle, Paris, France (Nicole Berti);
NMPC – National Museum (Natural History), Prague, Czech Republic (Josef Jelínek);
VNPC – Vladimír Novák collectio, Praha, Czech Republic.

RESULTS

Key to the *Hymenophorus* species known from Iran

1(2) Pronotum narrower, near base from both sides near scutellum with distinct holes (Figs 6, 7, 10). Anterior angles of pronotum conspicuous. .... *H. evae* sp. nov.

2(1) Pronotum more transverse, near base without holes from both sides of scutellum, only with obligue impressions (Figs 16, 17, 20, 24, 25). Anterior angles of pronotum not clearly conspicuous.

3(4) Pronotum distinctly sixangled, not broadest at base (Figs 16, 17). Punctation of pronotum sparser, interspaces between punctures broader (Fig. 20). Posterior angles of pronotum conspicuously rounded and obtuse angled. .... *H. gerdae* sp. nov.

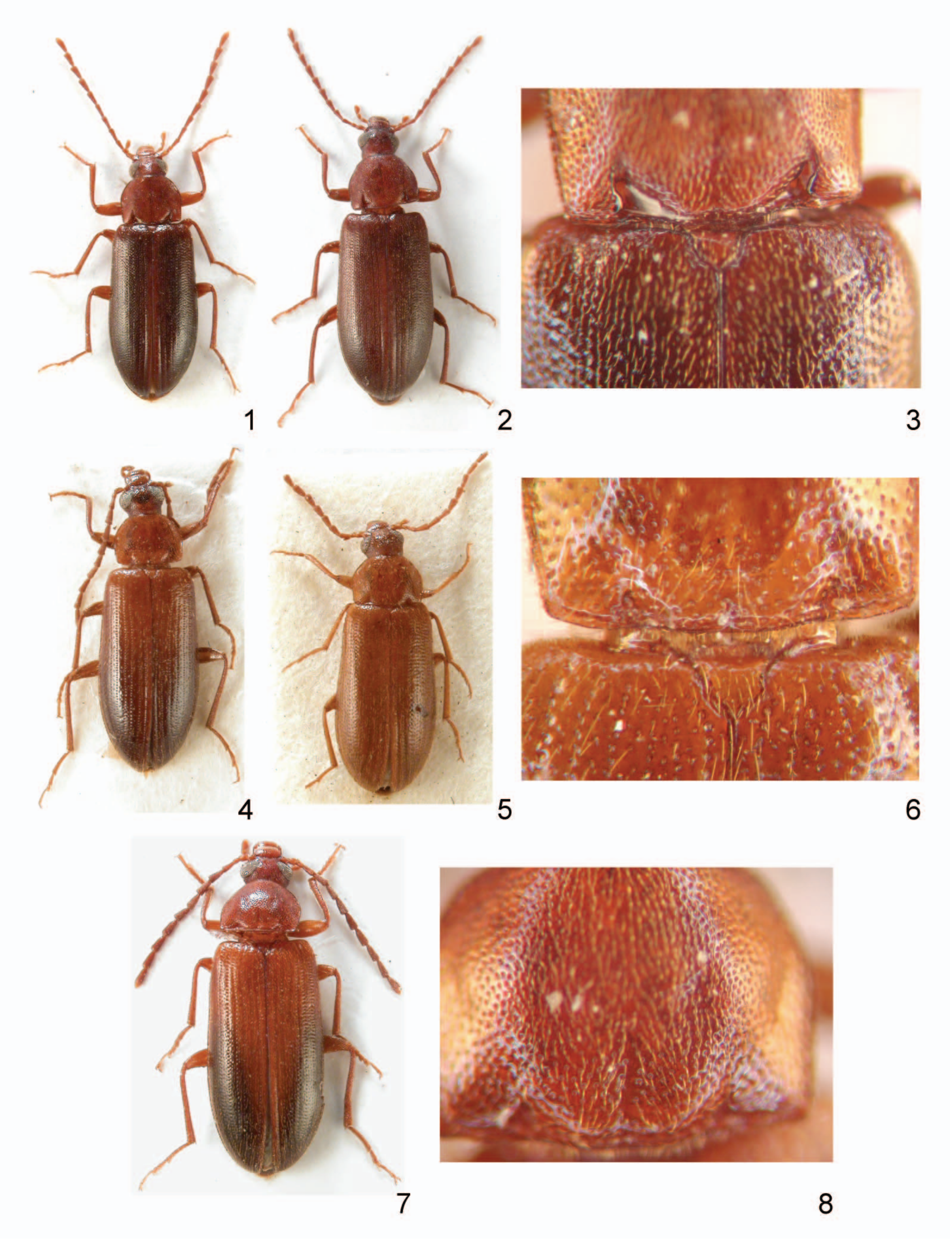
4(3) Pronotum not clearly sixangled (Fig. 24). Posterior angles not clearly obtuse-angled and not conspicuously rounded. Punctation of pronotum dense, interspaces between punctures narrower (Fig. 25). .... *H. indicus* Fairmaire, 1896

Hymenophorus evae sp. nov.
(Figs 1–3, 9–15)

TYPE MATERIAL. Holotype (male): labelled "Iran, prov. Hormozgan, Doveri vill. env., 1000 m, iv.2000, Plutenko lgt." (VNPC). Paratypes: (4 males, 9 females): "same data as holotype" (NMPC, VNPC); (1 male): "SE Iran, 13 km SSE Nikshahr (riv.), 8.–9.iv.1973, (Loc. No. 152), Exp. Nat. Mus. Praha" (NMPC).

DESCRIPTION OF THE HOLOTYPE (Fig. 1). Body lenght 5.65 mm, elongate, relatively flat, slightly shiny, from brown to dark brown. 2.96 times longer its width (widest at one third of elytral lenght, measured from base).

Head. Brown, relatively small, across eyes smaller than pronotum, with shorter sparse light setation. Clypeus something lighter. Eyes dark, transverse, space between eyes relatively large, distance between eyes larger than diameter of eye. Widest across eyes 0.80 mm (0.62 of pronotal base lenght). Lenght of head (visible part) 0.92 mm. Ocular index 37.22. Clypeus with shine, devoid of conspicuous punctation, slightly rugulosed. Head conspicuously and densely punctated, punctation relatively large and shallow. Interspaces very narrow and slightly granulated, head slightly shiny.



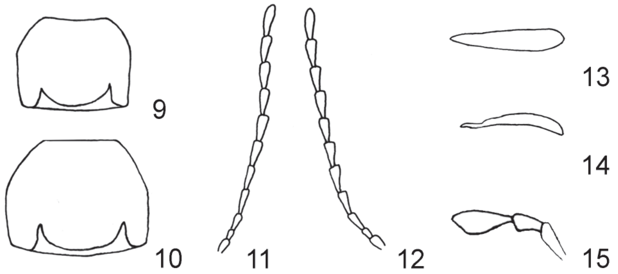
Figs 1–8. *Hymenophorus evae* sp. nov. 1– habitus of male (holotype), 2 – habitus of female, 3 – punctation of pronotum; *Hymenophorus gerdae* sp. nov. 4 – habitus of male (holotype), 5 – habitus of female, 6 – punctation of pronotum; *Hymenophorus indicus* Fairmaire. 7 – habitus of male, 8 – punctation of pronotum.

Antennae (Fig. 11). Relatively long; lenght of antennae 3.19 mm (reaching up 0.57 of body lenght), slightly shiny, all antennomeres universally light brown. Antennomere 2 shortest, antennomere 11 longest; antennomere 3 shorter than antennomeres 4–11. Antennomeres relatively narrow, antennomere 3 conspicuously widest on apex, from antennomere 4 antennomeres slightly serrate. Antennomeres slightly shiny, slightly rugulose, with light sparse setation. Ratio of relative lenghts of antennomeres from base to apex as follows: 0.88: 0.57: 1.00: 1.41: 1.38: 1.40: 1.45: 1.41: 1.47: 1.41: 1.69. Ratio L/W (lenght/most width) for antennomeres from base to apex as follows: 1.95: 1.36: 2.39: 2.71: 2.85: 3.00: 2.74: 2.49: 2.28: 2.52: 3.09.

Maxillary palpus (Fig. 15). Light brown as clypeus, somewhat lighter than head, with sparse light setation. Palpomere 2 widest on apex, 2.54 times longer than its width on apex; on apex 2.44 times broader than on its base. Penultimate palpomere widest on apex, here 2.11 times wider than at its base; slightly wider than palpomere 2 on apex. Penultimate palpomere 1.71 times longer than its width on apex. Ultimate palpomere inside broadly rounded, broadest at two thirds of its lenght. Outside linear at its first half, than slightly rounded to appex. Ultimate palpomere widest at two third, measured from base, here 2.23 times wider of its width on base; 2.88 times longer than its width on widest place. Ratio of relative lenghts of palpomeres 2–4 from base to apex as follows: 1.41: 1.00: 1.91. Ratio L/W (lenght/most width) of palpomeres 2–4 from base to apex as follows: 2.54: 1.71: 2.88 .

Pronotum (Figs 9, 10). Brown, slightly shiny with short light setation, sixangled, slightly transverse and narrower than elytra. Longest in the middle 1.08 mm, widest at its half 1.39 mm; width at base 1.29 mm. Pronotal index 83.25. Margins complete and conspicuous through their entire lenght, base from both sides slightly cut out. Posterior angles slightly obtuse angled. Margins up to half of lenght (from base to apex) linear, than regularly rounded and narrowed to apex. Anterior angles rounded and very slightly conspicuous. Apex margin direct, very slightly cut out in the middle. Two oblique holes from both sides near base clearly conspicuous. Surface densely punctated, punctures relatively coarse and large, interspaces very narrow and shiny.

Elytron. Dark brown, with short light setation, base, scuttelum and elytral suture samewhat lighter. Lenght 3.65 mm; widest at its third (from base to apex) 1.91 mm. Ratio L/W (lenght/most width) 1.91. Elytra with punctation, rows of punctures in elytral stries not clearly conspicuous. Diameter of elytral punctures samewhat larger than that of punctures on pronotum present. Punc-



Figs 9–15. *Hymenophorus evae* sp. nov. 9 – pronotum of male (holotype); 10 – pronotum of female; 11 – antennae of male (holotype); 12 – antennae of female; 13 – male genitalia from lateral view; 14 – male genitalia from dorsal view (dtto); 15 – maxillary palpus (holotype).

tures dense and coarse as that of pronotum. Interspaces very narrow, narrower than diameter of punctures, very slightly granulated, shiny. Scutellum light brown, regularly triangular with a few light setae. Margins complete, only at outer part of base lacking. Elytral epipleura relatively narrow, from base regularly narrowed to first abdominal sternite, thence in apical half runs parallel.

Legs. Universally brown, lighter than elytra. Femora relatively strong, with small sparse punctures, each with light setae, smooth without granulation, shiny. Tibia very narrow, narrowest on base, widest on apex, more matt, with conspicuous granulation and denser light setation. Tarsomeres with light denser setation. Penultimate tarsomeres of each tarsi with relatively small membraneous lobes, as wide as other tarsomeres on apex. Ultimate tarsomeres of each tarsi long and very narrow, narrower than rest of tarsomeres on apex. Ratio of relative lenghts of tarsomeres from base to apex as follows: protarsus: 1.00: 0.63: 0.51: 0.58: 1.54; mesotarsus: 1.00: 0.73: 0.45: 0.61: 1.34; metatarsus: 1.00: 0.44: 0.33: 0.87.

Anterior tarsal claws both with 7 visible teeth.

Ventral side of body. Brown, relatively matt, with light, short and sparse setation. Abdomen with five visible sternites, univerasally dark brown, with sparse and shallow punctures, punctures inside and interspaces conspicuously granulated, matt. Metasternum punctures samewhat larger than in mesosternum and prosternum.

Under side of thorax brown, with sparse, short, light setation, sparsely punctated. Interspaces with granulation, matt.

Genitalia (Figs 13, 14). Relatively small, light yellowish brown. Apical piece of genitalia linear, regularly narrowed to apex, triangular. Basal piece rounded. Ratio of lenghts of apical piece to basal piece 1: 3.76.

Variability in male paratypes. Six males: lenght: 5.47 mm approximately (ranging from 4.82 to 5.96 mm); head's lenght 1.02 mm approximately (ranging from 0.86 to 1.18 mm); head width 0.88 mm approximately (ranging from 0.79 to 0.93 mm). Ocular index approximately 37.30 (ranging from 35.37 to 39.32). Pronotal lenght (in middle) 1.03 mm approximately (ranging from 0.87 to 1.14 mm); pronotal width at base 1.22 mm approximately (ranging from 1.05 to 1.40 mm); pronotal index 84.56 approximately (ranging from 81.41 to 89.73). Elytral lenght 3.44 mm approximately (ranging from 2.96 to 3.85 mm). Elytral width 1.91 mm approximately (ranging from 1.39 to 1.94 mm).

Female (Figs 2, 10, 12). Anterior tarsal claws both with 5 visible teeth. Antennae shorter, reaching up only to half of body lenght, antennomeres 4–11 longer than antennomere 3. Antennomere 2 shortest, antennomere 11 longest. Ratio of relative lenghts of antennomeres from base to apex as follows: 0.75: 0.46: 1.00: 1.29: 1.23: 1.29: 1.35: 1.34: 1.29: 1.26: 1.73. Ratio L/W (lenght/most width) of antennomeres from base to apex as follows: 1.67: 1.26: 2.75: 2.47: 2.21: 2.02: 2.33: 2.12: 2.12: 2.11: 3.45. Ratio of relative lenghts of tarsomeres from base to apex as follows: protarsus: 1.00: 0.60: 0.46: 0.60: 1.31; mesotarsus: 1.00: 0.62: 0.41: 0.40:1.31; metatarsus: 1.00: 0.49: 0.34: 0.87. Variability in other nine females: lenght 6.38 mm approximately (ranging from 5.65 to 7.43 mm). Head lenght 1.06 mm approximately (ranging from 0.81 to 1.25 mm); head width 0.98 mm approximately (ranging from 0.88 to 1.09 mm). Ocular index 35.54 approximately (ranging from 32.43 to 37.75). Pronotal lenght (in middle) 1.25 mm approximately (ranging from 1.04 to 1.49 mm); pronotal width at base 1.46 mm approximately (ranging from 1.24 to 1.71 mm). Pronotal index 85.37 approximately (ranging from 83.42 to 87.06). Elytral lenght 4.11 mm approximately (ranging from 3.65 to 4.86 mm); elytral width 2.14 mm approximately (ranging from 1.87 to 2.60 mm).

Differential diagnosis (for details see the key above). *Hymenophorus evae* sp. nov. clearly differs from *Hymenophorus indicus* by having holes from both sides near pronotum base.

Name derivation. The new species is dedicated to my present wife Eva.

Hymenophorus gerdae **sp. nov.**

(Figs 4–6, 16–22)

TYPE MATERIAL. Holotype (male): labelled "E Iran, Deh Bakri, 1700–1750 m, 30.iv.–3.v.1973, (Loc. no. 186); Exp. Nat. Mus. Praha", (VNPC). Paratypes: (1 male, 1 female): "same data as holotype", (NMPC); (3 males, 4 females): "E Iran, Mohammabad, 1600 m, 3.–5.v.1973 (Loc. No. 187); Exp. Nat. Mus. Praha", (NMPC, VNPC); (1 male): "Iran, Sisakht, Dena, 2500–3000 m, 12.–13.vi.1973, (Loc. No. 241), Exp. Nat. Mus. Praha" (NMPC), (1 female): "W Iran, Zagros, Marg-e Malek, 3200 m, 1.vii.1970, (Loc. No. 39), Exp. Nat. Mus. Praha", (NMPC); (1 female): "S Iran, 29 km E Yasuj, 2300 m, 16.–17.vi.1973, (Loc. No. 245), Exp. Nat. Mus. Praha", (NMPC); (1 female): "S Iran, 13 km SSW Yasuj, 1800 m, 12.–13.vi.1973, 1800m, (Loc. No. 239); Exp. Nat. Mus. Praha", (NMPC).

DESCRIPTION OF THE HOLOTYPE (Fig. 4). Body lenght 7.11 mm, elongate, relatively flatt, slightly shiny, from light brown to dark brown; 2.98 times longer its width.

Head. Brown, relatively small, with eyes smaller than pronotum, with shorter sparse light setation. Clypeus samewhat lighter with sparser and longer light setation. Eyes dark, transverse. Spaces between eyes relatively large, but not larger than diameter of eye. Widest across eyes 1.05 mm (0.73 of pronotal base width). Lenght of head (visible part) 1.15 mm. Ocular index 31.14. Head conspicuously and densely punctated, punctures relatively large and shallow. Interspaces very narrow, shiny. Clypeus sparsely punctated.

Antennae (Fig. 18). Relatively long, lenght 3.87 mm (reaching up 0.55 of body lenght), all antennomeres universally brown, slightly rugulosed, with short light setation. Antennomeres from third widest on apex, conspicuously serrate, antennomere 2 shortest, antennomere 3 conspicuously shorter than antennomeres 4–11. Ratio of relative lenghts of antennomeres from base to apex as follows: 0.86: 0.55: 1.00: 1.37: 1.34: 1.41: 1.33: 1.44: 1.41: 1.42: 1.50. Ratio L/W (lenght/most width) for antennomeres from base to apex as follows: 2.01: 2.05: 2.34: 2.38: 2.31: 2.45: 2.28: 2.94: 2.51: 2.65: 3.37.

Maxillary palpus (Fig. 22). Light brown as clypeus, somewhat lighter than head, with light setation and sporadic long setae. Palpomere 2 widest on apex, 2.31 times longer than its width on apex; on apex 2.45 times broader than on its base. Penultimate palpomere widest on apex, here 2.39 times wider than at its base; slightly wider than palpomere 2 on apex. Penultimate palpomere 1.35 times longer than its width on apex. Ultimate palpomere triangular, broadest on apex, here 2.83 times wider of its width on base; 1.33 times longer than its width on apex. Ratio of relative lenghts of palpomeres 2–4 from base to apex as follows: 1.61: 1.00: 1.91. Ratio L/W (lenght/most width) of palpomeres 2–4 from base to apex as follows: 2.31: 1.35: 1.33.

Pronotum (Figs 16, 17). Light brown, shiny with elatively sparse light setation, slightly sixangled, more transverse and narrower than elytra. Longest in the middle 1.15 mm, widest at its half 1.58 mm; width at base 1.44 mm. Pronotal index 79.78. Margins complete and conspicuous through their entire lenght, base from both sides slightly cut out. Posterior angles distinctly obtuse angled. Margins up to half of lenght (from base to apex) linear, in apical half regularly rounded. Anterior angles roundly obtuse angled and very slightly conspicuous. Apex margin direct. Two oblique basal impressions from both sides of pronotuj base clearly conspicuous. Surface punctated, punctures large but not so dense, interspaces larger than diameter of punctures, shiny.

Elytron. Brown, basal half samewhat lighter, apical half darker, with relatively sparse, longer light setation. Lenght 4.46 mm; widest at its third (from base to apex) 2.39 mm. Ratio L/W (lenght/most width) 1.87. Elytra punctation present, rows of punctures in elytral stries clearly conspicuous. Diameter of punctures at rows in stries same than that of punctures present on elytral intervals. Punctures in elytral stries dense and coarse. Interspaces between punctures in stries very narrow, narrower than diameter of punctures, very slightly granulated, shiny. Punctures in elytral intervals sparser, interspaces between punctures larger than diameter of punctures. Scutellum light brown, regularly triangular a few light setae present. Elytral epipleura brown, relatively narrow; from base regularly narrowed to first abdominal sternite, here narrowest, in apical half from end of abdominal sternite 2 slightly broader.

Legs. Universally brown, with short light setation. Femora relatively strong, slightly shiny. Tibia very narrow, narrowest on base, widest on apex, more matt, with conspicuous granulation and denser light setation. Tarsomeres with light denser setation. Penultimate tarsomeres of each tarsi with relatively small membraneous lobes, wider than other tarsomeres on apex. Ultimate tarsomeres of each tarsi long and very narrow, narrower than rest of tarsomeres on apex. Ratio of relative lenghts of tarsomeres from base to apex as follows: protarsus: 1.00: 0.79: 0.77: 0.92: 2.01; mesotarsus: 1.00: 0.70: 0.46: 0.52: 1.15; metatarsus: 1.00: 0.44: 0.27: 0.67.

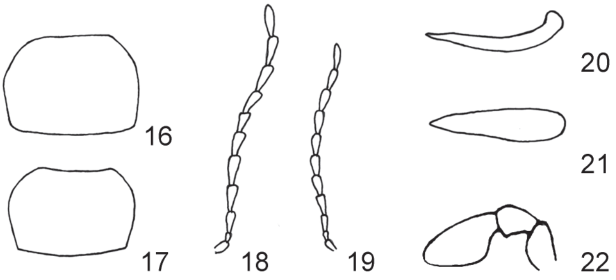
Anterior tarsal claws both with 9 visible teeth.

Ventral side of body. Brown, shinning, abdomen more matt, with light, short and sparse setation. Abdomen with five visible sternites, brown, in middle slightly lighter, with small, sparse and shallow punctures, interspaces conspicuously granulated, matt. Episternum of mesothorax and metathorax relatively deeply punctated, mesosternum and metasternum sparsely punctated. Mesothorax and metathorax devoid of conspicuous microsculpture, shiny.

Under side of thorax light brown, with sparse, light setation and sparse large punctures. Interspaces slightly shinning.

Genitalia (Figs 20, 21). Relatively small, light yellowish brown, apical part darker, brown. Apical piece of genitalia linear, regularly narrowed to apex, triangular. Basal piece first from base strongly rounded, than second half linear as apical piece. Ratio of lenghts of apical piece to basal piece 1: 2.42.

Variability in male paratypes. Six males: lenght 5.74 mm approximately (ranging from 4.29 to 7.11 mm). Head lenght 0.98 mm approximately (ranging from 0.83 to 1.15 mm); head width 0.96 mm approximately (ranging from 0.81 to 1.10 mm). Ocular index 32.23 approximately (ranging from 28.98 to 35.96). Pronotal lenght (in middle) 0.97 mm approximately (ranging from 0.78 to 1.15 mm); pronotal width (at base) 1.35 mm approximately (ranging from 1.07 to 1.60 mm). Pronotal index 72.15 approximately (ranging from 67.00 to 79.78). Elytral lenght 3.74 mm approximately (ranging from 2.77 to 4.46 mm); elytral width 2.00 mm approximately (ranging from 1.46 to 2.39 mm).

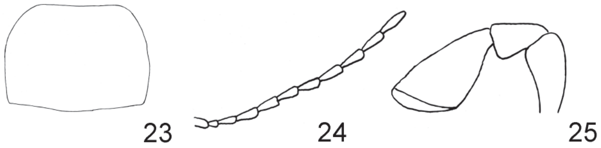


Figs 16–22. *Hymenophorus gerdae* sp. nov. 16 – pronotum of male (holotype); 17– pronotum of female; 18 – antennae of male (holotype); 19 – antennae of female; 20 – male genitalia from lateral view; 21 – male genitalia from dorsal view (dtto); 22 – maxillary palpus (holotype).

Female (Fig. 17, 19). Anterior tarsal claws both with 5 visible teeth. Universally brown, slightly brillant, with sparse, relatively long light setation. Antennae samewhat shorter than half of body lenght (0.45). Antennomere 3 very slightly shorter than antennomere 4. Antennomeres from fourth very slightly serrate. Ratio of relative lenghts of antennomeres from base to apex as follows: 0.69: 0.57: 1.00: 1.06: 1.11: 1.12: 1.09: 1.26: 1.23: 1.26: 1.42. Ratio L/W (lenght/most width) of antennomeres from base to apex as follows: 1.41: 1.69: 1.46: 1.83: 2.04: 1.86: 2.43: 3.05: 2.54: 2.21: 3.03. Ratio of relative lenghts of tarsomeres from base to apex as follows: protarsus: 1.00: 0.52: 0.57: 0.78: 1.56; mesotarsus: 1.00: 0.51:0.37: 0.44: 1.02; metatarsus: 1.00: 0.39: 0.33: 0.63. Measurements in other eight females: lenght 6.37 mm approximately (ranging from 4.84 to 8.13 mm). Head lenght 1.15 mm approximately (ranging from 0.91 to 1.54 mm); head width 1.03 mm approximately (ranging from 0.81 to 1.30 mm). Ocular index 36.15 approximately (ranging from 29.71 to 42.63). Pronotal lenght (in middle) 1.10 mm approximately (ranging from 0.88 to 1.41 mm). Pronotal width at base 1.52 mm approximately (ranging from 1.20 to 2.06 mm). Pronotal index 72.88 approximately (ranging from 65.54 to 79.36). Elytral lenght 4.14 mm approximately (ranging from 3.14 to 5.30 mm); elytral width 2.28 mm approximately (ranging from 1.91 to 2.89 mm).

Differential diagnosis (for details see the key above). *Hymenophorus gerdae* sp. nov. differs from *Hymenophorus indicus* mainly by density of punctation of pronotum (*H. gerdae* sp. nov. with distinctly sparser punctation).

Name derivation. New species is named in honour of my best four-legged friend dog Gerda.



Figs 23–25. *Hymenophorus indicus* Fairmaire. 23 – pronotum of male; 24 – antennae of male; 25 – maxillary palpus of male.

***Hymenophorus indicus* Fairmaire, 1896**

(Figs 7–8, 23–25)

Hymenophorus indicus Fairmaire, 1896: 58 (type locality: Himalaja, Simla).

Type material studied. 1 male, 1 female, labelled: “Himalaja, Simla Type L. Fairmaire coll.” (MNHN).

Additional Material studied. (1 male, 1 female): “C Iran p. Fars, Yâsűg NW Ðîraâz (vill. Kâkân), 30° 40’ N 51° 43’ E, 13.vi.1999, lgt. P. Kabátek” (VNPC); (2 males, 2 females): “SW Iran, Pol-e Tang, 60 km NW Andimeshk, 10.–11.iv.1977, (Loc. No. 284); Exp. Nat. Mus. Praha”, (NMPC, VNPC); (1 male): “Iran, Horramabad, 12.v.1999, Orzsulik lgt.”, (VNPC).

Distribution. Species known previously only from the Himalaya, Simla (Fairmaire 1896), first record from Iran.

Acknowledgements

Thanks are due to Josef Jelínek (NMPC) for oportunity to see the “Iran Expeditions Material” deposited in the NMPC and to Miss Nicole Berti for loaning of the type material from MNHN.

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Species richness of gall midges (Diptera: Cecidomyiidae) in the main biogeographical regions of the world

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Abstract. The diversity of living and fossil Cecidomyiidae in the major biogeographical regions of the world is assessed on the basis of the numbers of species and genera formally described up to the end of 2003. A tabulation of the 5657 species in 613 genera summarises records for the Palaearctic, Nearctic, Neotropical, Afrotropical, Indomalayan and Australian and Oceanian regions at the levels of species, genus, tribe, supertribe and subfamily. On a world basis, totals for the four main subfamilies are: Catotrichinae: seven species in one genus; Lestremiinae: 558 species in 59 genera; Porricondylinae: 647 species in 90 genera; Cecidomyiinae: 4179 species in 463 genera; 266 species belong in the category of unplaced species. Of the whole family, 3122 species in 344 genera occur in the Palaearctic, 1202 species in 181 genera in the Nearctic, 520 species in 153 genera in the Neotropical, 203 species in 85 genera in the Afrotropical, 462 species in 109 genera in the Indomalayan and 212 species in 59 genera in the Australasian and Oceanian regions. Eighty-nine known fossil species in 54 genera mainly from amber and copal dating from the Upper Jurassic, Lower Cretaceous, Upper Cretaceous, Eocene, Oligocene, Miocene, Pliocene and Holocene, were found scattered in all biogeographical regions except the Australasian and Oceanian regions. The oldest fossil species, *Catotricha mesozoica* Kovalev, 1990, found in Siberia from the Upper Jurassic and Lower Cretaceous, gives evidence that the Cecidomyiidae probably originated and developed in the Mesozoic. The biology of the main taxa is summarised and major pest and beneficial species are noted. The biology of Catotrichinae is unknown, Lestremiinae and Porricondylinae are mycophagous and saprophagous, Cecidomyiinae are phytophagous inducing galls on host plants or inhabiting plants without making galls and some are zoophagous and mycophagous. About 40 species of Cecidomyiinae are important pests of cultivated plants and forest trees; some are restricted to small areas and some have secondarily Holarctic or nearly cosmopolitan distributions, having been transferred to new areas with their host plants. Several species are beneficial and are used as agents in biological control of small invertebrates and weed plants. Many species of Cecidomyiidae remain undescribed and the number of described species is only part of the total number of species existing in the world. *Mikiola? pontiensis* Villalta, 1957, described from traces of fossil galls on the leaves of *Fagus castaneaefolia* Ung. in Spain from the Miocene is a missidentification. The galls are formed by *Phegomyia fagicola* (Kieffer, 1901), the species known from the recent, based on the similarity of the shape of galls. A new tribe, Mikiolini, is established for the genus *Mikiola*.

Biogeography, distribution, Diptera, Cecidomyiidae, Catotrichinae, Lestremiinae, Porricondylinae, Cecidomyiinae, Palaearctic, Nearctic, Neotropical, Afrotropical (Ethiopian), Indomalayan (Oriental), Australasian and Oceanian regions, Holarctic region, pests, biological control, beneficial species, fossil, Mesozoic, new tribus

INTRODUCTION

It is not easy to say how many gall midge species occur in each continent or biogeographical region of the world. The number of known gall midge species, as with the number of species of other animal and plant groups, changes with time: new species appear or seem to appear, having been discovered by scientists, and other species die out and are recorded as extinct. The number of species is also influenced by the level and progress of knowledge and is affected very significantly by the human factor, especially by the numbers of specialists that have studied the gall midge fauna in particular areas. Also of importance are the methods used to study faunal compositions in various parts of the world.

Although new species and genera from all biogeographical regions continue to be described, some species names disappear from use as they are found to be invalid or fall into synonymy. Therefore, the number of species in some genera, and the number of genera, may be reduced by such actions. It is not easy to follow all these changes in the literature to give a true picture of the current situation on a world-wide basis. In the present paper I try to show the species richness of living species of gall midges, together with fossil species, that have been recorded in the main biogeographical regions of the world. Most species included in this study are still living but some have become extinct during recent geological epochs, and some are approaching extinction or have become extinct recently as a result of human activities. It is much more difficult to determine the number of fossil species that have existed.

Gall midges, the Cecidomyiidae, belong to one of the most speciose families of Diptera. Adults are usually small flies, 0.5–8 mm long, with long antennae and with wing veins reduced in number. Larvae are generally elongate-cylindrical, sometimes coloured. They have on the ventral side of the prothoracic segment a sclerotised structure, the sternal spatula, which is found only in the Cecidomyiidae and, although it has often been secondarily lost, is a synapomorphy indicating that the family is monophyletic. Its characteristic shapes are of importance in the identification of species and genera. Larvae of the more primitive subfamilies, the Lestremiinae and Porricondylinae, are usually saprophagous or mycophagous. They develop in decaying organic matter, in mouldy plants and rotten wood, under the bark of trees, in mushrooms or in cones of conifers. Larvae of the subfamily Cecidomyiinae are phytophagous, zoophagous or mycophagous. Many phytophagous larvae are gall makers inducing galls on various plants but some live free in flower heads or in stems of plants, without making galls. Some phytophagous species are serious pests of cultivated plants and forest trees but, on the other hand, several phytophagous species are used in biological control of weeds. Larvae of some species live as inquilines in galls of other gall midges or other insects. Zoophagous larvae are predators of other gall midges, aphids, mites, coccids, or other small arthropods. Some of them are used in biological control of pests. Several species are endoparasites of aphids, psyllids and tingids. The biology of many species is completely unknown (Skuhravá et al., 1984, Gagné 1989b, 1994, Harris 1994).

The history of the classification of Cecidomyiidae is given below. Difficulties encountered in classifying and analysing taxa result from the fact that type specimens and other original material of most species described by early researchers, especially those described by Kieffer at the end of the 19th century and at the beginning of 20th century have been lost, including original material of other authors that was destroyed during the second world war. The names of some species and genera are based on immature stages (larvae or pupae), or even only on galls. According to the *International Code of Zoological Nomenclature*, species names based on the "work of an animal" (= galls) and names founded on immature stages, described before 1931, are accepted as valid, with their original author and date.

MATERIAL AND METHODS

I have gathered the information which is used in this article since 1978 when I was invited to prepare the family Cecidomyiidae for the *Catalogue of Palaearctic Diptera* (Skuhravá 1986). It was necessary to compile all original papers with descriptions of species and genera of gall midges since Linné´s 10th edition of his *Systema Naturae* in 1758. Data on each species and each genus was written on separate index cards which were put into boxes. Data on distribution of each species in the Palaearctic region was obtained from many papers scattered in various journals. Gradually data on genera and species occurring in other biogeographical regions were also added to the card-index. Periodically additional data from *Zoological Record* and *Entomological Abstracts* were compiled to add to the index. At present this card-index of the family Cecidomyiidae includes several thousand cards for the species and genera of the whole world.

The cut-off point for the data included in this paper is the end of 2003, which coincides almost exactly with the publication of *A Catalog of the Cecidomyiidae* (*Diptera*) *of the World* (Gagné, 2004). Inevitably the publication of this major authoritative work makes some major and many minor changes to the taxonomic treatment of the Cecidomyiidae post-2003. My paper is essentially historical and for current taxonomic opinions on the status of supertribes, tribes, genera and species Gagné (2004) should be consulted. Important differences between our taxonomic opinions are noted at appropriate points in my text.

In the present article I use the terminology of Udvardy (1975) for the biogeographical regions of the world. He introduced the widely used terminology for geographical distributions of plants and animals which was formerly disunited, with phytogeography and zoogeography using different terms for identical areas. In addition Udvardy (1975) replaced the earlier terms “Ethiopian” and “Oriental” by more suitable terms “Afrotropical” and “Indomalayan”. In contrast to Udvardy I use instead of his term “realm” the earlier and more suitable term “region”.

RESULTS

Family Cecidomyiidae

In my index the family Cecidomyiidae includes 5657 living and fossil species in 613 genera which are distributed throughout the main biogeographical regions. The smallest and phylogenetically oldest subfamily, Catotrichinae, contains 7 species in a single genus; Lestremiinae contains 558 species in 59 genera; Porricondylinae contains 647 species in 90 genera and the largest subfamily, Cecidomyiinae, contains 4179 species in 463 genera and 266 species are unplaced. Of the whole

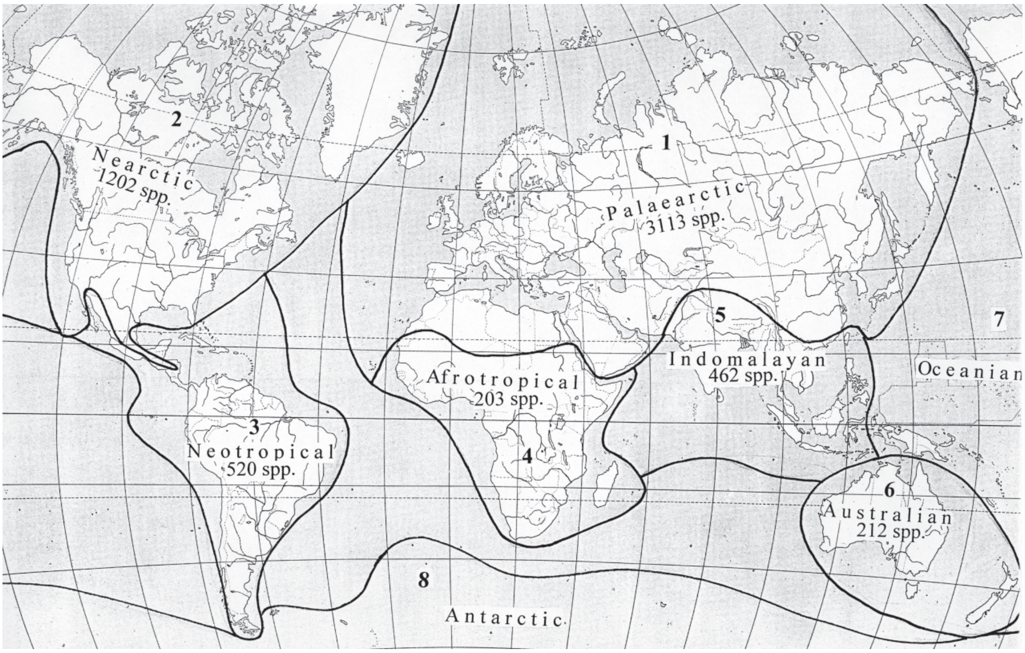

Fig. 1. Biogeographical regions of the world with species numbers of Cecidomyiidae: 1 – Palaearctic, 2 – Nearctic, 3 – Neotropical, 4 – Afrotropical, 5 – Indomalayan, 6 – Australian, 7 – Oceanian, 8 – Antarctic regions. Adapted from Udvardy (1975). Species richness for the Australasian and Oceanian regions is given together under the Australian region.

Table 1. Distribution of living and fossil Cecidomyiidae given as numbers of species and genera in the major biogeographical regions of the world. Abbreviations: FOS – number of fossil species, not assigned to regions; PAL – Palaearctic; NEA – Nearctic; number of species with Holarctic distribution are given in parentheses under species numbers in both regions; NET – Neotropical; AFR – Afrotropical; INM – Indomalayan; AOC – Australian and Oceanian Regions; WORLD – total number of species described up to the end of the year 2003; numbers given in the last column are not a simple sum of occurrence of species given in the biogeographical regions because some species occur in two or more biogeographical regions

taxon	FOS	PAL	NEA	NET	AFR	INM	AOC	World
Subfamily Catotrichinae								
Catotrichini								
Catotricha Edwards, 1938	1	3	2				1	7
total	**1**	**3**	**2**				**1**	**7**
Subfamily Lestremiinae								
Acoenoniini								
Acoenonia Pritchard, 1947		3 (1)	2 (1)					4
Aprionini								
Aprionus Kieffer, 1894	1	96 (3)	8 (3)			1		103
Apriocryptus Mamaev et Berest, 1992								
Mycophila Felt, 1911		5 (2)	3 (2)			1	1	7
Tekomyia Möhn, 1960		1						1
Yukawamyia Mamaev et Zaitzev, 1996		1						1
Baeonotini								
Baeonotus Byers, 1969			1					1
Bryomyiini								
Bryomyia Kieffer, 1895		11 (2)	2 (2)			1		11
Tomonomyia Berest, 1993								
Heterogenella Mamaev, 1963	1	12	1					14
Cervuatina Berest, 1993								
Skuhraviana Mamaev, 1963		2 (1)	1 (1)					2
Campylomyzini								
Campylomyza Meigen, 1818	2	23 (3)	3 (3)			1	(20)	28
Corinthomyia Felt, 1911		1 (1)	1 (1)					1
Cretocordylomyia Gagné, 1977	1							1
Excrescentia Mamaev et Berest, 1991		1						1
Micropteromyia Mamaev, 1960		1						1
Neurolyga Rondani, 1840		21 (5)	8 (5)				1	26
Cordylomyia Felt, 1911								
Prosaprionus Kieffer, 1913								
Microcordylomyia Mamaev et Mohrig, 1975								
Psadaria Enderlein, 1940			1					1
Catochini Edwards								
Catarete Edwards, 1929		1						1
Catocha Haliday, 1833	1	1 (2)	5 (1)			2		7
Eucatocha Edwards, 1938								
Anocha Pritchard, 1947								
Cretocatocha Gagné, 1977	1							1
Neocatocha Felt, 1912		1 (1)	1 (1)					1
Tritozyga Loew, 1862		1	1					2
Forbesomyiini								
Forbesomyia Malloch, 1914			1					1

Table l. continued

taxon	FOS	PAL	NEA	NET	AFR	INM	AOC	World
Lestremiini								
Allarete Pritchard, 1951		6 (2)	3 (2)		1	2		10
Allaretina Mamaev, 1994								
Allaretella Meyer et Spungis, 1994		1						1
Anarete Haliday, 1833		17 (4)	10 (4)	1		5	2	29
Anaretella Enderlein, 1911		5 (2)	2 (2)				1	6
Conarete Pritchard, 1951	1		4	1	1	6		11
Gongromastix Enderlein, 1936		3 (1)	2 (1)			3		8
Pararete Pritchard, 1951								
Lestremia Macquart, 1826	1	6 (2)	3 (2)	2	1	6	3	17
Mangogrostix Mamaev, 1985						1		1
Neolestremia Mani, 1934						3		3
Wasmanniella Kieffer, 1898		1	1			1		3
Micromyini								
Anodontoceras Yukawa, 1967		1				1		2
Antennardia Mamaev, 1963		1						1
Micromya Rondani, 1840	1	7 (1)	1 (1)	1	1	4		12
Ceratomyia Felt, 1911								
Crespiniella Kieffer, 1924								
Monardia Kieffer, 1895	1	19 (2)	4 (2)					20
Pezomyia Kieffer, 1913								
Mycopriona Mamaev, 1965								
Vulcanardia Mamaev, 1993								
Furcapriona Mamaev et Zaitzev, 1996								
Procnomyia Mamaev et Zaitzev, 1996								
Polyardis Pritchard, 1947		14 (3)	6 (3)					17
Pseudoperomyia Jaschhof, 1999		7				22		29
Termitomastus Silvestri, 1901				1				1
Trichopteromyia Williston, 1896		5 (5)	2 (5)	1	1	1		6
Xylopriona Kieffer, 1913		11 (2)	3 (2)					11
Tetraxyphus Kieffer, 1913								
Peromyiini								
Gagnea Jaschhof, 2001		1						1
Peromyia Kieffer, 1894	5	113 (9)	9 (9)	1	1	4		124
Pteridomyiini								
Pteridomyia Jaschhof, 2003							2	2
Pseudomonardia Jaschhof, 2003							11	11
Strobliellini								
Amedia Jaschhof, 1997			1					1
Amediella Jaschhof, 2003							1	1
Eleniella Berest, 2001		1						1
Eltxo Arillo et Nel, 2000	1							1
Groveriella Mamaev, 1977		2						2
Strobliella Kieffer, 1898		2 (1)	1 (1)					2
Unplaced genera								
Calospatha Kieffer, 1913		1						1
Ipomyia Colless, 1965							1	1
Lithomyza Scudder, 1877	1							1
Stenospatha Kieffer, 1913		1						1
Tricampylomyza Kieffer, 1919					1			1
Trichelospatha Kieffer, 1913		1						1
Tricolpodia Kieffer, 1913		1						1

Table 1. continued

taxon	FOS	PAL	NEA	NET	AFR	INM	AOC	World
Nomen dubium								
Lasiopteryx Stephens, 1829		1						1
Lestremiinae total	**17**	**409**	**88**	**8**	**7**	**65**	**43**	**557**
Subfamily Porricondylinae								
Asynaptini								
Asycola Spungis, 1991		1						1
Asynapta Loew, 1850	2	19	12	3	5	5	1	46
Ruebsaamenia Kieffer, 1894								
Camptomyia Kieffer, 1894	1	56	8	1		9		75
Colomyia Kieffer, 1891	1	3				1		5
Epicola Spungis, 1991		1						1
Feltomyina Alexander, 1936				1				1
Parasynapta Panelius, 1965		1	1					2
Pseudocamptomyia Parnell, 1971			1		2			3
Asycampta Mamaev et Zaitzev, 1997								
Stackelbergiella Marikovskij, 1958		1						1
Zatsepinomyia Mamaev et Zaitzev,1997					2			2
Bryocryptini								
Bryocrypta Kieffer, 1896	5	7				1		13
Diallactini								
Cretohaplusia Arillo et Nel, 2000	1							1
Diallactia Gagné, 2004		6	1					7
Diallactes Kieffer, 1894								
Ferovisenda Mamaev, 1972		1						1
Gynapteromyia Mamaev, 1965		1						1
Haplusia Karsch, 1877	1	8	2	3	1	2	1	18
Chastomera Skuse, 1888								
Palaeocolpodia Meunier, 1904								
Johnsonomyia Felt, 1908								
Wyattella Mamaev, 1966		2				1		3
Dicerurini								
Bulbepidosis Mamaev, 1990		1						1
Dicerura Kieffer, 1898		18	7					26
Iridomyza Rübsaamen, 1899								
Hormosomyia Felt, 1919								
Ulmomyia Mamaev, 1960								
Neosynepidosis Parnell, 1971								
Hilversidia Mamaev, 1966		1						1
Neotetraneuromyia Spungis, 1987		2						2
Neurepidosis Spungis, 1987		3						3
Paratetraneuromyia Spungis, 1987		2 (1)	1 (1)					2
Pterepidosis Mamaev, 1990		2						2
Synepidosis Mamaev, 1964		2						2
Tetraneuromyia Mamaev, 1964		5						5
Ubinomyia Mamaev, 1990		1						1
Dirhizini								
Dirhiza Loew, 1850	1	2	1					4
Heteropezini								
Brittenia Edwards, 1941		1						1
Cretomiastor Gagné, 1977	1							1
Frirenia Kieffer, 1894	1	1						2

Table l. continued

taxon	FOS	PAL	NEA	NET	AFR	INM	AOC	World
Henria Wyatt, 1959	1	1	2					4
Barnesina Pritchard, 1960								
Heteropeza Winnertz, 1846	1	1 (1)	2 (1)				2	4
Oligarces Meinert, 1865								
Heteropezina Pritchard, 1960		1 (1)	1 (1)			1		2
Heteropezula Wyatt, 1967		1						1
Leptosyna Kieffer, 1894	1	4						4
Meunieria Kieffer in Meunier,1904	1							1
Miastor Meinert, 1864	1	2 (1)	1 (1)				4	6
Peromiastor Kieffer, 1913								
Monodicrana Loew, 1850	1							1
Neostenoptera Meunier, 1901	1				1			2
Nikandria Mamaev, 1964		1						1
Palaeospaniocera Meunier, 1901	1							1
Holoneurini								
Cassidoides Mamaev, 1960		7						7
Coccopsilis Harris, 2004		3						3
Coccopsis Meijere, 1901								
Cryptoneurus Mamaev, 1964		3				1		4
Dallaiella Mamaev, 1997		1						1
Holoneurus Kieffer, 1895		8	3	1		1	1	14
Schistoneurus Mamaev, 1964		2	1					3
Porricondylini								
Arctepidosis Mamaev, 1990		2						2
Basicondyla Parnell, 1971			1					1
Cedrocrypta Kieffer, 1919		1				1		2
Claspettomyia Grover, 1964		16 (1)	3 (1)		1	8		27
Pachylabis Panelius, 1965								
Clinophaena Kieffer, 1913					1			1
Colpodia Winnertz, 1853	3	3				2	1	9
Dendrepidosis Mamaev, 1990		3						3
Dentepidosis Mamaev, 1990		1						1
Desertepidosis Mamaev et Sojunov, 1989		2						2
Furcepidosis Mamaev, 1990		1						1
Harpomyia Felt, 1916						1		1
Isocolpodia Parnell, 1971			3					3
Jamalepidosis Mamaev, 1990		3						3
Lamellepidosis Mamaev, 1990		1						1
Misocosmus Kieffer, 1913						1		1
Monepidosis Mamaev, 1966		4	1					5
Monocolpodia Mamaev, 1990		3						3
Neocolpodia Mamaev, 1964		2	1					3
Palaeocolpodia Meunier, 1904	1							1
Pallidepidosis Mamaev et Zaitzev, 1996		2						2
Paracolpodia Parnell, 1971		2	1					3
Parepidosis Kieffer, 1912		9	2			2		13
Porricondyla Rondani, 1840	6	62 (2)	21 (2)		3	6	18	116
Epidosis Loew, 1850								
Dicroneurus Kieffer, 1895								
Phaenepidosis Kieffer, 1913								
Synaptella Kieffer, 1913								
Synarthrella Kieffer, 1913								
Vesperomyia Marikovskij, 1958								

Table l. continued

taxon	FOS	PAL	NEA	NET	AFR	INM	AOC	World
Prosepidosis Kieffer, 1912		1						1
Pseudepidosis Mamaev, 1966		5						5
Sclerepidosis Mamaev, 1990		1						1
Sensepidosis Mamaev, 1990		1						1
Spungisomyia Mamaev et Zaitzev, 1996		1						1
Stomatocolpodia Mamaev, 1990		3						3
Trichepidosis Mamaev, 1990		1						1
Solntseviini								
Grisepidosis Mamaev, 1968		2						2
Solntsevia Mamaev, 1965		2	1					3
Winnertziini								
Clinorhytis Kieffer, 1896		1						1
Cretowinnertzia Gagné, 1977	1							1
Cryptoxylomyia Mamaev, 1995		1						1
Kronomyia Felt, 1911		4	1					5
Trichoxylomyia Mamaev, 1964								
Parwinnertzia Felt, 1919		1	1					2
Rhipidoxylomyia Mamaev, 1964		4				1		5
Sylvenomyia Mamaev et Zaitzev, 1998		1						1
Winnertzia Rondani, 1860	5	96 (1)	9 (1)		1	2		113
Prowinnertzia Kieffer, 1911								
Uncertain systematic position								
Brephometra Strand, 1910 (new name for *Pero* Meinert, 1910)				1				1
Meinertomyia Felt, 1911 (new name for *Pero* Meinert, 1870)								
Unplaced								
Rabindrodiplosis Grover, 1964						2		2
Porricondylinae total	**38**	**426**	**89**	**9**	**17**	**48**	**28**	**647**
Subfamily Cecidomyiinae **Supertribe Asphondyliidi**								
Asphondyliini								
Apoasphondylia Gagné, 1973						2		2
Diceromyia Felt, 1918								
Asphondylia Loew, 1850		66	77	89	18	13	7	270
Monasphondylia Kieffer, 1913								
Gisonobasis Rübsaamen, 1915								
Ischnonyx Rübsaamen, 1916								
Eumarchalia Del Guercio, 1914								
Halimodendromyia Marik., 1965								
Eoasphondylia Möhn, 1960								
Ussurasphondylia Kovalev, 1964								
Chenasphondylia Mamaev, 1972								
Asphoxenomyia Felt, 1927						1		1
Bruggmanniella Tavares, 1909				5				5
Hemibruggmanniella Möhn, 1961								
Eocincticornia Felt, 1915							2	2
Hemiasphondylia Möhn, 1960			1	2				3
Heterasphondylia Möhn, 1960				1				1
Parazalepidota Maia, 2001				1				1
Perasphondylia Möhn, 1960				2				2
Probruggmanniella Möhn, 1961		1						1

Table 1. continued

taxon	FOS	PAL	NEA	NET	AFR	INM	AOC	World
Pseudasphondylia Monzen, 1955		5				1	1	7
Philadelphella Kovalev, 1964								
Pumilomyia Stefani, 1919		1						1
Rhoasphondylia Möhn, 1960				3				3
Sciasphondylia Möhn, 1960				1				1
Tavaresomyia Möhn, 1961				1				1
Tetrasphondylia Kieffer, 1913					1			1
Xenhormomyia Felt, 1920					2			2
Zalepidota Rübsaamen, 1907				4				4
Ozobia Kieffer, 1913								
Oxasphondylia Felt, 1915								
Polystephini								
Daphnephila Kieffer, 1905		1				3		4
Kochiomyia Mamaev, 1969		7						7
Turkmenomyia Marik., 1957								
Desertovelum Mamaev, 1972								
Polystepha Kieffer, 1897		3	19	2				24
Cincticornia Felt, 1908								
Pseudokochiomyia Fedotova, 1984		6						6
Schizomyiini								
Ameliomyia Möhn, 1960				1				1
Anasphondylia Tavares, 1920				1				1
Aposchizomyia Gagné, 1993					6			6
Asteralobia Kovalev, 1964		13						13
Bruggmannia Tavares, 1906			1	18				18
Feltomyia Kieffer, 1913								
Burseramyia Möhn, 1960				1				1
Houardiella Kieffer, 1912		2						2
Kalidiomyia Fedotova, 1984								
Kiefferia Mik, 1895		1					1	2
Luzonomyia Felt, 1918							1	1
Macroporpa Rübsaamen, 1916				2				2
Metasphondylia Tavares, 1918				1				1
Okriomyia Kolesík, 1998							2	2
Paraschizomyia Möhn, 1961		1						1
Pisoniamyia Möhn, 1960				3				3
Pisphondylia Möhn, 1960				2				2
Placochela Rübsaamen, 1916		3						3
Proasphondylia Felt, 1915				3				3
Schizandrobia Kovalev, 1964		2						2
Schizomyia Kieffer, 1889		2	15	5	6	19		47
Parasphondylia Kieffer, 1913								
Skusemyia Kolesík, 1995							1	1
Stephomyia Tavares, 1916			1	7				8
total		**114**	**114**	**155**	**33**	**39**	**15**	**469**
Supertribe Brachineuridi								
Brachineurini								
Brachineura Rondani, 1840		15	3				2	20
Spaniocera Winnertz, 1853								
Acroectasis Rübsaamen, 1910								
Brachyneurella Kieffer, 1913								
Brachyneurina Mamaev, 1967		4						4

Table l. continued

taxon	FOS	PAL	NEA	NET	AFR	INM	AOC	World
Chrybaneura Gagné, 1968				1				1
Coccidomyia Felt, 1911			1					1
Epimyia Felt, 1911			1					1
Epimyiella Mamaev, 1967		1						1
Rhizomyia Kieffer, 1898		13	8			1		22
total		**33**	**13**	**1**		**1**	**2**	**50**
Supertribe Cecidomyiidi								
Anadiplosini								
Alexomyia Felt, 1921				1				1
Anadiplosis Tavares, 1916				4				4
Machaeriobia Rübsaamen, 1916				1				1
Ruebsaamenodiplosis Tavares, 1920								
Scopolodiplosis Felt, 1915				1				1
Uleella Rübsaamen, 1907				1				1
Aphidoletini								
Aphidoletes Kieffer, 1904		4	3	1		1	1	5
Bremia Rondani, 1860	1	6	8	1	2	2		2
Chanchudiplosis Grover & Bakhshi, 1978						1		1
Chelobremia Kieffer, 1912		1						1
Heterobremia Felt, 1920					1			1
Heterocontarinia Hardy, 1960							1	1
Homobremia Kieffer, 1912		1	1		1			3
Monobremia Kieffer, 1912		2				2		4
Tribremia Kieffer, 1912		1						1
Cecidomyiini								
Acacidiplosis Gagné, 1993					13			13
Acodiplosis Kieffer, 1895		2						2
Ametrodiplosis Rübsaamen, 1910		15	1			1		17
Anabremia Kieffer, 1912		6						6
Apagodiplosis Gagné, 1973			1					1
Aschistonyx Rübsaamen, 1917		2						2
Atrichosema Kieffer, 1904		1						1
Blaesodiplosis Gagné, 1973			3					3
Blastodiplosis Kieffer, 1912		2						2
Brachydiplosis Rübsaamen, 1910		1						1
Braueriella Kieffer, 1896		1						1
Caryomyia Felt, 1909			12					12
Cecidomyia Meigen, 1803	8	8	9	1		1		27
Dentifibula Felt, 1908		2	1			3		6
Muirodiplosis Grover, 1965								
Diplosiola Solinas, 1965		1						1
Etsuhoa Inouye, 1959		10						10
Giardomyia Felt, 1908		1	6			3	2	12
Hadrobremia Kieffer, 1912		1						1
Hygrodiplosis Kieffer, 1912		1						1
Inulomyia Stelter, 1965		1						1
Loewiola Kieffer, 1896		3						3
Macrodiplosis Kieffer, 1895		3	10					13
Massalongia Kieffer, 1897		4						4
Monarthropalpus Rübs., 1892		1 (1)	1 (1)					1
Mycetodiplosis Kieffer, 1912		1						1
Octodiplosis Giard, 1894		1						1

Table l. continued

taxon	FOS	PAL	NEA	NET	AFR	INM	AOC	World
Paradiplosis Felt, 1908		2	2					4
Agevillea Hubault, 1945								
Parallelodiplosis Rübsaamen, 1910		2	15	1		6	2	25
Phyllodiplosis Kieffer, 1912		1						1
Pinyonia Gagné, 1973			1					1
Plemeliella Seitner, 1908		2						2
Procontarinia Kieffer et Cecconi, 1906		2			1	10	1	12
Erosomyia Felt, 1911								
Indodiplosis Felt, 1916								
Mangodiplosis Tavares, 1918								
Amradiplosis Mani, 1947								
Amraemyia Rao, 1950								
Prodiplosis Felt, 1908		3	9					12
Geisenheyneria Rübsaamen, 1910								
Putoniella Kieffer, 1896		1	1					2
Sequoiomyia Möhn, 1960	2							2
Sitodiplosis Kieffer, 1913		4	1			1		4
Taxodiomyia Gagné, 1968			3					3
Tokiwadiplosis Simbolon et Yukawa, 1992		1						1
Trilobomyia Marikovskij, 1956		1						1
Trogodiplosis Gagné, 1985			1					1
Xenodiplosis Felt, 1911		1						1
Xylodiplosis Kieffer, 1894		3	1			2		6
Centrodiplosini								
Centrodiplosis Kieffer et Jörgensen, 1910				1				1
Cystodiplosis Kieffer et Jörgensen, 1910				1				1
Jorgensenia Kieffer, 1913				1				1
Clinodiplosini								
Anthodiplosis Kieffer, 1912		1						1
Autodiplosis Tavares, 1920				1				1
Buhromyiella Holz, 1970		1						1
Camptodiplosis Kieffer, 1912		2						2
Chauliodontomyia Gagné, 1969				2				2
Cleitodiplosis Tavares, 1921				1				1
Clinodiplosis Kieffer, 1894	1	16	51	16	1	8		93
Collula Strandt, 1926		1						1
Dichaetia Mamaev, 1965		1						1
Dichodiplosis Rübsaamen, 1910		1	1	1				3
Charidiplosis Tavares, 1918								
Aphodiplosis Gagné, 1973								
Echinella Mamaev, 1965		2						2
Harmandiola Skuhravá, 1997		5	7					12
Harmandia Kieffer, 1896								
Houardodiplosis Tavares, 1925				1				1
Hyperdiplosis Felt, 1908			5	4		4		13
Iatrophobia Rübsaamen, 1916				1				1
Liodiplosis Gagné, 2001				3				3
Mycocecis Edwards, 1922		1						1
Mycodiplosis Rübsaamen, 1895		25	7	5	2	4	1	44
Isodiplosis Rübsaamen, 1910								
Toxomyia Felt, 1911								
Trilobiella Del Guercio, 1918								
Kittada Agarwal, 1956								

Table 1. continued

taxon	FOS	PAL	NEA	NET	AFR	INM	AOC	World
Neoisodiplosis Holz, 1970		2						2
Neomycodiplosis Holz, 1970		1						1
Piranea Janežič, 1990		1						1
Resseliella Seitner, 1906		27	16		1	3		47
Geodiplosis Kieffer, 1909								
Profeltiella Kieffer, 1912								
Thomasiniana Strand, 1916								
Gillotiella Kieffer, 1924								
Wichmanniella Möhn, 1955								
Schismatodiplosis Rübs., 1916				1				1
Tricholaba Rübsaamen, 1917		5						5
Trigonodiplosis Rübsaamen, 1917		1						1
Trilobophora Marikovskij, 1953		1						1
Contariniini								
Anisostephus Rübsaamen, 1917		2						2
Chamaediplosis Gagné, 1990			1					1
Contarinia Rondani, 1860	1	225 (7)	61 (7)	8	9	13	18	332
Sissudiplosis Mani, 1943								
Bothriochloamyia Rao et Sharma, 1977								
Contarinomyia Fedotova, 1991								
Diodaulus Rübsaamen, 1917		2						2
Drisina Giard, 1893		1						1
Endaphis Kieffer, 1896		2 (1)	2 (1)	1	1			5
Pseudendaphis Barnes, 1954								
Occuloxenium Mamaev, 1973								
Gobidiplosis Mamaev, 1972		2						2
Ilidiplosis Fedotova, 1992								
Halodiplosis Kieffer, 1912		97	1					98
Onodiplosis Felt, 1916								
Asiodiplosis Marik., 1955								
Haloxylophaga Marik., 1955								
Tyloceramyia Marik., 1956								
Monarthropselaphus Marik., 1957								
Halocnemomyia Marik., 1965								
Desertomyia Marik., 1975								
Micrasiodiplosis Mamaeva, 1980								
Bojalodiplosis Fedotova, 1985								
Gemmidiplosis Fedotova, 1992								
Myricomyia Kieffer, 1900		1						1
Odinadiplosis Mani, 1935		1				1		2
Prodiplosis Felt, 1908			7	2		1		10
Sphaerodiplosis Rübsaamen, 1916				1				1
Stenodiplosis Reuter, 1895		4 (2)	5 (2)	1	4	1	3	10
Tinconaria Gagné, 1967								
Allocontarinia Solinas, 1986								
Taxodiomyia Gagné, 1969	1		3					3
Thecodiplosis Kieffer, 1895		2	4					6
Thurauia Rübsaamen, 1899		2						2
Zeuxidiplosis Kieffer, 1904		1	1		1		1	1
Coquillettomyiini								
Antichiridium Rübsaamen, 1911		2						2
Coquillettomyia Felt, 1908		18 (2)	5 (2)	2	1	13		37
Almatamyia Marikovskij, 1953								

Table 1. continued

taxon	FOS	PAL	NEA	NET	AFR	INM	AOC	World
Strobilodiplosis Möhn, 1955								
Pelodiplosis Möhn, 1955								
Picrodiplosis Möhn, 1955								
Serratomyia Grover, 1965								
Ancylodiplosis Gagné, 1973								
Calliperodiplosis Grover, 1979								
Halteromyia Grover, 1979								
Epidiplosis Felt, 1908		4	1			1		6
Gersonomyia Nijveldt, 1965								
Karshomyia Felt, 1908		25 (3)	15 (3)	1	1	10		52
Lobodiplosis Felt, 1908								
Metadiplosis Felt, 1908								
Plesiobremia Kieffer, 1912								
Tristephanus Kieffer, 1913								
Hiastatus Marikovskij, 1956								
Apamargamyia Sharma et Rao, 1978								
Mamaevia Skuhravá, 1967		2						2
Spilodiplosis Kovalev et Mamaev, 1966		1						
Lestodiplosini								
Adiplosis Felt, 1908			1					1
Ampelosucta Stefani, 1912		1						1
Arthrocnodax Rübsaamen, 1895		45	3	2	1	4	2	57
Feltodiplosis Kieffer, 1913								
Asyomyia Marikovskij, 1953								
Atopodiplosis Gagné, 1997				1				1
Cartodiplosis Gagné, 1973			1					1
Diadiplosis Felt, 1911		2	2	7	8	6	3	28
Kalodiplosis Felt, 1915								
Coccodiplosis Meijere, 1917								
Cleodiplosis Felt, 1922								
Schizobremia Felt, 1926								
Olesicoccus Borgmeier, 1931								
Phagodiplosis Blanchard, 1938								
Ghesquierinia Barnes, 1939								
Nipponodiplosis Harris, 1968								
Vincentodiplosis Harris, 1968								
Golanudiplosis Grover et Prasad, 1968								
Dicrodiplosis Kieffer, 1895		3	3	1	4	2	1	13
Xiphodiplosis Felt, 1915								
Peridiplosis Felt, 1918								
Tjanshaniella Marikovskij, 1953								
Endopsylla De Meijere, 1907		2						2
Feltiella Rübsaamen, 1910		2	5	3	1	2	1	10
Therodiplosis Kieffer, 1912								
Acaroletes Kieffer, 1913								
Lamprodiplosis Kieffer, 1912		1						1
Lestodiplosis Kieffer, 1894	2	98	48	6	6	10	3	168
Coprodiplosis Kieffer, 1894								
Moreschiella Del Guercio, 1918								
Adelgimyza Del Guercio, 1919								
Cecidomyella Del Guercio, 1919								
Theatodiplosis Tavares, 1922								
Chiliodiplosis Möhn, 1955								
Phonodiplosis Möhn, 1955								

Table l. continued

taxon	FOS	PAL	NEA	NET	AFR	INM	AOC	World
Mohwadiplosis Rao, 1957						1		1
Nanodiplosis Kieffer, 1913					1			1
Odontodiplosis Felt, 1908		4	3			6		13
Ischnodiplosis Kieffer, 1913								
Pectinodiplosis Felt, 1918			1					1
Silvestriola Skuhravá, 1997		11	1	1	1	3		13
Silvestrina Kieffer, 1912								
Stictobremia Kieffer, 1912		1						1
Tessaradiplosis Baylac, 1988		1						1
Thripsobremia Barnes, 1930			2	1				3
Tricontarinia Kieffer, 1910			1					1
Trilobia Del Guercio, 1918		1						1
Triommata Barnes, 1931					1	1		2
Triommatomyia Mamaev, 1961		2						2
Trisopsis Kieffer, 1912		10	4		2	8	1	24
Plagiodiplosis Kieffer, 1913								
Uncinulella Del Guercio, 1918		1						1
Lopesiini								
Allodiplosis Kieffer et Jörgensen, 1910				1				1
Austrolopesia Kolesík, 1999							1	1
Cordiamyia Maia, 1996				1				1
Ctenodactylomyia Felt, 1915			1	2				2
Liebeliola Kieffer et Jörgensen, 1910				1			1	2
Lopesia Rübsaamen, 1908			1	9	3		1	14
Lopesiella Tavares, 1908					1			1
Myrciamyia Maia, 1996			1					1
Obolodiplosis Felt, 1908		1 (1)	1 (1)					1
Rochadiplosis Tavares, 1917				1				1
Tetradiplosis Kieffer et Jörgensen, 1910				1				1
Monodiplosini								
Buhriella Stelter, 1960		1						1
Gynandrobremia Mamaev, 1965		5						5
Holobremia Kieffer, 1912		2				1		3
Monodiplosis Rübsaamen, 1910		1						1
Stroblophila Kieffer, 1912		1						1
Hormomyiini (Planetellini)								
Geromyia Coutin et Harris, 1969		1			1	2		3
Haplodiplosis Rübsaamen, 1910		1						1
Orseolia Kieffer et Mass., 1902		3			3	22		26
Planetella Westwood, 1840		28	22			1		51
Hormomyia Loew, 1850								
Amaurosiphon Rübs.,1910								
Dichrona Rübs.,1899								
Diplolaboncus Rübs., 1917								
Dishormomyia Kffr., 1912								
Dyodiplosis Rübs.,1910								
Jaapiola Rübs., 1914								
Paurosphondylus Rübs., 1917								
Proshormomyia Kffr., 1913								
Pseudhormomyia Kffr., 1898								
Taphodiplosis Kffr., 1912								
Trishormomyia Kffr., 1912								

Table l. continued

taxon	FOS	PAL	NEA	NET	AFR	INM	AOC	World
partial sum	**16**	**823**	**384**	**105**	**72**	**161**	**44**	**1556**
Unplaced genera								
Afrodiplosis Felt, 1926					1			1
Allobremia Barnes, 1928						1	1	2
Anasphodiplosis Gagné, 1994				1				1
Andirodiplosis Tavares, 1920				1				1
Androdiplosis Felt, 1915						1		1
Aplecus Kieffer, 1913					1			1
Arrabiadaeamyia Maia, 2001				1				1
Asphotrophia Barnes, 1928						3		3
Anjerodiplosis Mani, 1938								
Udumbaria Grover, 1963								
Astrodiplosis Felt, 1913				1				1
Athidiplosis Gagné, 1993					2			2
Austrodiplosis Bréthes, 1919				1				1
Baeodiplosis Kieffer, 1913					1			1
Blaesodiplosis Gagné, 1973			3					3
Bungomyia Nayar, 1949						1		1
Cacoplecus Kieffer, 1913					2			2
Callitridiplosis Kolesik, 2000							1	1
Calodiplosis Tavares, 1908					1			1
Chaetodiplosis Kieffer, 1913					2			2
Chrysodiplosis Kieffer, 1911					1	1		2
Clusiamyia Maia, 1999				2				2
Coccomyza Del Guercio, 1918							1	1
Coelodiplosis Kieffer, 1913						1		1
Compsodiplosis Tavares, 1909				1				1
Conodiplosis Kieffer, 1913					1			1
Contodiplosis Gagné, 1994				3				3
Cordylodiplosis Gagné, 1973			1					1
Ctenodiplosis Kieffer, 1913					2			2
Dactylodiplosis Rübsaamen, 1916				2				2
Delodiplosis Tavares, 1908					1			1
Diplecus Kieffer, 1913						1	1	2
Diplodontomyia Rao, 1951						2		2
Enallodiplosis Gagné, 1994				1				1
Eohormomyia Felt, 1915					1			1
Epihormomyia Felt, 1915				2				2
Eucalyptodiplosis Kolesik, 2002							2	2
Eumerosema Kieffer, 1913						1		1
Farquharsonia Collin, 1922					2			2
Frauenfeldiella Rübsaamen, 190				1				1
Gladiodiplosis Kolesik, 2000							1	1
Glenodiplosis Gagné, 1973			1					1
Gnesiodiplosis Tavares, 1917				1				1
Gongrodiplosis Gagné, 1973			1					1
Gonioclema Skuse, 1888							1	1
Gynodiplosis Felt, 1927						1		1
Heliodiplosis Felt, 1918						1		1
Spatholobomyia Rao, 1950								
Holodiplosis Kieffer, 1913					2			2
Horidiplosis Felt, 1920						6		6
Huradiplosis Nijveldt, 1968				1				1
Hypodiplosis Kieffer, 1913						1		1

Table l. continued

taxon	FOS	PAL	NEA	NET	AFR	INM	AOC	World
Kamptodiplosis Felt, 1918						2		2
Kimadiplosis Gagné, 1993					1			1
Kronodiplosis Felt, 1918						1		1
Lasiodiplosis Kieffer, 1912					1			1
Lepidobremia Kieffer, 1912					1			1
Lepidodiplosis Kieffer, 1911					3			3
Litchiomyia Yang et Luo, 1999		1						1
Lobopteromyia Felt, 1908			1					1
Lophodiplosis Gagné, 1997							5	5
Manilkaramyia Maia, 2001				1				1
Megaulus Rübsaamen, 1916				1				1
Megommata Barnes, 1939					2	4		6
Mesodiplosis Kolesik, 2000							1	1
Meterdiplosis Barnes, 1927						2		2
Microdiplosis Tavares, 1908					1			1
Microplecus Kieffer, 1913					1			1
Mikaniadiplosis Gagné, 2001				1				1
Mitodiplosis Kieffer, 1914					1			1
Moehniella Wünsch, 1979				1				1
Neobaeomyza Brethes, 1914				1				1
Oligoxenomyia Felt, 1927						1		1
Olpodiplosis Gagné, 1973			1					1
Oribremia Kieffer, 1913						1		1
Orthodiplosis Kieffer, 1913					1			1
Ouradiplosis Felt, 1915				1				1
Pachydiplosis Kieffer, 1913					1			1
Perodiplosis Kieffer, 1913					1			1
Phyllocecidium Givulescu, 1984 (known on gall only)	1							1
Pilodiplosis Gagné, 1973			1					1
Pipaldiplosis Mani, 1942						1		1
Pitydiplosis Gagné, 1973			1					1
Planodiplosis Kieffer, 1911					1			1
Platydiplosis Gagné, 1973			1					1
Plecophorus Kieffer, 1913					1			1
Plectrodiplosis Gagné, 1973			1					1
Plesiodiplosis Kieffer, 1912				1				1
Plutodiplosis Kieffer, 1912						2		2
Proterodiplosis Wyatt, 1963							1	1
Pruthodiplosis Mani, 1934						1		1
Punarnavomyia Mani, 1953						1		1
Radulella Del Guercio, 1918					1			1
Raodiplosis Felt, 1920						1		1
Schizodiplosis Kieffer, 1913				1				1
Stephodiplosis Tavares, 1908					1		1	2
Streptodiplosis Felt, 1916						1		1
Styraxdiplosis Tavares, 1915				2				2
Tanaodiplosis Gagné, 1973			1					1
Thaumadiplosis Gagné, 1973			1					1
Thorodiplosis Felt, 1921						1		1
Trissodiplosis Kieffer, 1913					1			1
Tropidiplosis Gagné, 1973			1					1
Vaccinidiplosis Gagné, 1994			1					1
Xenasphondylia Felt, 1915				1				1

Table l. continued

taxon	FOS	PAL	NEA	NET	AFR	INM	AOC	World
Youngomyia Felt, 1908								
Delphodiplosis Felt, 1915			1	4		1		6
partial sum of unplaced		1	17	34	39	41	16	149
total	**16**	**824**	**401**	**139**	**111**	**202**	**60**	**1705**
Supertribe Lasiopteridi								
Alycaulini								
Alycaulus Rübsaamen, 1916				3				3
Asteromyia Felt, 1910			8	1				9
Astictoneura Gagné, 1969			1					1
Atolasioptera Möhn, 1975				1				1
Baccharomyia Tavares, 1917				4				4
Brachylasioptera Möhn, 1964				2				2
Calamomyia Gagné, 1969			19					19
Chilophaga Gagné, 1969			4					4
Edestochilus Gagné, 1969			1					1
Edestosperma Gagné, 1969			1					1
Epilasioptera Möhn, 1964				1				1
Geraldesia Tavares, 1917				3				3
Lobolasioptera Möhn, 1964				1				1
Marilasioptera Möhn, 1975				1				1
Meunieriella Kieffer, 1909			1	20				21
Dolicholabis Tavares, 1918								
Neolasioptera Felt, 1905			64	70				134
Physalidicola Brethes, 1917								
Neurolasioptera Brethes, 1922								
Luisiera Tavares, 1922								
Dilasioptera Möhn, 1964								
Protaplonyx Felt, 1916			1					1
Smilasioptera Möhn, 1975				1				1
Xipholasioptera Gagné, 1995			1					1
Camptoneuromyiini								
Camptoneuromyia Felt, 1908		1	6	9				16
Copinolasioptera Möhn, 1975				1				1
Dialeria Tavares, 1918				1				1
Domolasioptera Möhn, 1975				7				7
Incolasioptera Möhn, 1975				1				1
Salvalasioptera Möhn, 1975				1				1
Lasiopterini								
Actilasioptera Gagné, 1998							6	6
Aplonyx Stefani-Perez, 1908		1						1
Artemisiomyia Kovalev, 1972		1						1
Atraphaxiola Fedotova, 1986		1						1
Baldratia Kieffer, 1897		36			2			38
Baldratiella Kieffer, 1913								
Arafavilla Mamaev et Mirumjan, 1990								
Careopalpis Marikovskij, 1961		14						14
Exopsyllomyia Mamaev, 1972		3						3
Hybolasioptera Rübsaamen, 1915		2	1					3
Isolasioptera Möhn, 1964			1	2				3
Izeniola Fedotova, 1985		3						3
Lasioptera Meigen, 1818	2	50	34	1	7	21	10	125
Prolasioptera Kieffer, 1913								

Table l. continued

taxon	FOS	PAL	NEA	NET	AFR	INM	AOC	World
Thomasiella Rübsaamen, 1916								
Gastiniella Del Guercio, 1918								
Monilipennella Del Guercio, 1918								
Neoprotoplonyx Rao, 1952								
Bimba Grover, 1962								
Microlasioptera Skuhravá, 1981		1						1
Ozirhincus Rondani, 1840		5 (1)	1 (1)					5
Clinorhyncha Loew, 1850								
Primofavilla Mamaev, 1972		3						3
Stefaniella Kieffer, 1898		9						9
Stefaniola Kieffer, 1913		107			1	1		101
Baldratiola Kieffer, 1913								
Dibaldratia Kieffer, 1913								
Salsolomyia Tavares, 1919								
Haloxylonomyia Marik., 1953								
Aridofavilla Mamaev, 1972								
Trotteriini								
Trotteria Kieffer, 1901		9	2	5	1			17
Unplaced genera								
Angeiomyia Kieffer et Herbst, 1909				1				1
Calmonia Tavares, 1917				2				2
Eugeniamyia Maia, Mendonca et Romanowski, 1997				1				1
Mayteniella Maia, 2001				1				1
Paulliniamyia Maia, 2001				1				1
total	**2**	**246**	**146**	**142**	**11**	**22**	**16**	**576**
Supertribe Oligotrophidi								
Dasineurini								
Alliomyia Gagné, 1994		1						1
Allomyia Fedotova, 1991								
Amerhapha Rübsaamen, 1914		1						1
Androsacemyia Fedotova, 1992		1						1
Arcivena Gagné, 1984				1				1
Arnoldiola Strandt, 1926		11	1					12
Artemisiobia Kovalev, 1967		1						1
Astragalomyia Fedotova, 1993		1						1
Austrolauthia Brethes, 1914				1				1
Bayeriola Gagné, 1990		4						4
Bayeria Rübsaamen, 1914								
Berberisomyia Kovalev, 1972		1						1
Brassomyia Mitroshina et Fedotova,1993		2						2
Celticecis Gagné, 1983		1	10					11
Coniophora Nijveldt, 1959		5						5
Cotoneasteromyia Fedotova, 1991		1						1
Cystiphora Kieffer, 1892		6	1				1	7
Laubertia Rübsaamen, 1914								
Dasineura Rondani, 1840	1	335 (10)	112 (10)	13	5	9	7	487
Perrisia Rondani, 1846								
Dasyneuriola Marikovskij, 1961		5						5
Dryomyia Kieffer, 1898		4					1	5
Ephedromyia Marikovskij, 1953		6						6
Euphorbomyia Fedotova, 1994		4						4
Fabomyia Fedotova, 1991		11						11

Table l. continued

taxon	FOS	PAL	NEA	NET	AFR	INM	AOC	World
Geocrypta Kieffer, 1913		6						6
Gephyraulus Rübsaamen, 1915		9						9
Paragephyraulus Solinas, 1982								
Lepidiomyia Fedotova, 1992								
Spirorhynchomyia Fedotova, 1992								
Geraniomyia Fedotova, 1991		1						1
Giraudiella Rübsaamen, 1915		2						2
Gypsophyllomyia Fedotova, 1991		1						1
Hasegawaia Monzen, 1937		1						1
Herbomyia Möhn, 1955		1						1
Jaapiella Rübsaamen, 1915		80						80
Janetia Kieffer, 1896		7						7
Kiefferiola Tavares, 1920								
Kaltenbachiola Hedicke, 1938		1	2					3
Lathyromyza Rübsaamen, 1915		3						3
Macrolabis Kieffer, 1892		50						50
Neomikiella Hedicke, 1938		3						3
Polygonomyia Fedotova, 1991		2						2
Potentillomyia Fedotova, 1990		1						1
Procystiphora Felt, 1915		1	2					3
Rabdophaga Westwood, 1847		40	40		1	1		82
Dichelomyia Rübsaamen, 1892								
Bertieria Kieffer, 1896								
Rhabdophaga Kieffer, 1901								
Helicomyia Rübsaamen, 1915								
Bremiolina Mamaev & Mirumian, 1990								
Schueziella Möhn, 1961		2						2
Scorzoneromyia Fedotova, 1991		1						1
Sophoromyia Fedotova, 1984		2						2
Spartiomyia Kieffer, 1913		1						1
Spiraeanthomyia Fedotova, 1989		2						2
Spiromyia Fedotova, 1991		1						1
Spurgia Gagné, 1990		8						8
Sterrhaulus Rübsaamen, 1915		1						1
Syrenomyia Fedotova, 1991		1						1
Tavolgomyia Fedotova, 1991		1						1
Taxomyia Rübsaamen, 1912		1						1
Wachtliella Rübsaamen, 1915		9						9
Xerephedromyia Mamaev, 1972		4						4
Ledomyiini								
Isogynandromyia Spungis, 1981		1						1
Lauthia Kieffer, 1912		13	12	2	3			30
Cryptolauthia Kieffer, 1912								
Microperrisia Kieffer, 1912								
Phaenolauthia Kieffer, 1912								
Properrisia Kieffer, 1912								
Sphaenolauthia Kieffer, 1912								
Nanolauthia Kieffer, 1913								
Ledomyia Kieffer, 1895	1	6	7	1	1			16
Neuromyia Felt, 1911								
Ledomyiella Meunier, 1904	5							5
Plesiolauthia Mamaev, 1967		1						1
Prolauthia Rübsaamen, 1915		1						1

Table l. continued

taxon	FOS	PAL	NEA	NET	AFR	INM	AOC	World
Mikiolini								
Mikiola Kieffer, 1896		2						2
Oligotrophini								
Acericecis Gagné, 1983	1	1	1					3
Harrisomyia Skuhravá, 1986								
Acerovesiculomyia Fedotova, 2003		1						1
Angeiomyia Kieffer & Herbst, 1909				1				1
Apiomyia Kieffer, 1912		1						1
Apodiplosis Tavares, 1922				1				1
Arceuthomyia Kieffer, 1913		2						2
Blastomyia Kieffer, 1913		1						1
Bremiola Rübsaamen, 1915		16						16
Intranerviola Fedotova, 1986								
Radicaliola Fedotova, 1993								
Craneiobia Kieffer, 1913		1	1					2
Didymomyia Rübsaamen, 1912	1	1						1
Ficiomyia Felt, 1922			1					1
Guarephila Tavares, 1909				1				1
Guignonia Kieffer, 1912		1						1
Haplopalpus Rübsaamen, 1916				1				1
Hartigiola Rübsaamen, 1912	1	1						2
Iteomyia Kieffer, 1913		3	2					5
Janetiella Kieffer, 1898		16	14	3				31
Ceratomyia Fedotova, 1991								
Labiatomyia Fedotova, 1987		6						6
Lyciomyia Kieffer et Jörgensen, 1910				1				1
Lygocecis Gagné, 1975		2	2					4
Masakimyia Yukawa et Sunose, 1976		1						1
Mikomya Kieffer, 1912		1						1
Myrciariamyia Maia, 1994				1				1
Neodasyneuriola Marikovskij, 1958		1						1
Neomitranthella Maia, 1996				1				1
Ochnephila Kieffer, 1914					1			1
Oligotrophus Latreille, 1805		5	3					8
Pernettyella Kieffer & Herbst, 1909				1				1
Phegomyia Kieffer, 1913	1	2						2
Physemocecis Rübsaamen, 1914		2						2
Primavera Gagné, 2002			1					1
Promikiola Kieffer et Herbst, 1911				1				1
Psectrosema Kieffer, 1904		21				5		26
Amblardiella Kieffer, 1913								
Isosandalum Kieffer, 1913								
Debskiana Mam. et Bekn., 1983								
Harrisiana Fedotova, 1992								
Mamaeviana Fedotova, 1992								
Marikovskiana Fedotova, 1992								
Pseudomikiola Bréthes, 1917				1				1
Riveraella Kieffer et Herbst, 1911				1				1
Rondaniola Hedicke, 1938		1						1
Rosomyia Fedotova, 1987		3						3
Sackenomyia Felt, 1908		2	3					5
Phlyctidobia Kieffer, 1912								
Scheueria Kieffer et Herbst, 1909				2				2
Schmidtiella Rübsaamen, 1914		1						1

Table 1. continued

taxon	FOS	PAL	NEA	NET	AFR	INM	AOC	World
Semudobia Kieffer, 1913		5 (5)	5 (5)					7
Trichoperrisia Kieffer, 1913						1		1
Trigonomyia Kolesik, 1996							3	3
Uleia Rübsaamen, 1905				1				1
Walshomyia Felt, 1908	1		5					5
Xyloperrisia Kieffer, 1913				2				2
Zygiobia Kieffer, 1913		2						2
Poomyiini								
Epicalamus Sylvén, 1997		1						1
Mayetiola Kieffer, 1896		30 (1)	2 (1)				1	31
Poomyia Rübsaamen, 1910								
Caulomyia Rübsaamen, 1915								
Pemphigocecis Rübsaamen, 1915								
Rhopalomyiini								
Rhopalomyia Rübsaamen, 1892		161	86	3		1	4	255
Diarthronomyia Felt, 1908								
Misospatha Kieffer, 1913								
Calopedila Kieffer, 1913								
Panteliola Kieffer, 1913								
Dichelonyx Rübsaamen, 1914								
Boucheella Rübsaamen, 1914								
Dictyomyia Tavares, 1919								
Navasiella Tavares, 1919								
Eudictyomyia Tavares, 1920								
Artemisiobia Kovalev, 1967								
Dracunculomyia Fedotova, 1999								
Arenaromyia Fedotova, 1999								
Absinthomyia Fedotova, 1999								
Seriphidomyia Fedotova, 2000								
Polynomyia Fedotova, 2001								
Yukawyx Fedotova, 2001								
Pupascleromyia Fedotova, 2001								
total	**12**	**958**	**315**	**40**	**11**	**17**	**17**	**1361**
Supertribe Stomatosematidi								
Stomatosematini								
Stomatosema Kieffer, 1913		4 (1)	3 (1)	2	4	4		15
Baeomyza Kieffer, 1913								
Jeannellomyia Kieffer, 1913								
Vanchidiplosis Nayar, 1949								
Neohaplusia Rao,1951								
Haplusiella Rao, 1952								
Hallomyia Kieffer, 1912		1 (1)	1 (1)			2		3
Didactylomyia Felt, 1911								
total		**5**	**4**	**2**	**4**	**4**		**18**
Cecidomyiinae – total	**30**	**2180**	**993**	**479**	**170**	**285**	**110**	**4179**

family, 3122 species in 344 genera occur in the Palaearctic; 1202 species in 181 genera in the Nearctic; 520 species in 153 genera in the Neotropical, 203 species in 85 genera in the Afrotropical; 462 species in 109 genera in the Indomalayan and 212 species in 59 genera in the Australasian and

Oceanian Regions (Fig.1). 89 species in 54 genera are known as fossils from remains or traces in amber or copal with records scattered throughout the main biogeographical regions, with the exception of the Australasian and Oceanian Regions.

All gall midge species described in the world up to the end of 2003 are arranged in Table 1 under the four subfamilies, the Catotrichinae, Lestremiinae, Porricondylinae and Cecidomyiinae. Each subfamily is divided into tribes, and, in addition, the Cecidomyiinae is divided into supertribes. The distribution of living species is given as total numbers in genera according to biogeographical regions. Fossil species are given together and are not assigned to a particular region; their discovery in the biogeographical regions is noted in comments under relevant taxonomic groups.

The family Cecidomyiidae was established by Macquart (1838) as Cécidomydes. Many researchers in the 19th century used the term with a broader or narrower sense. Rondani (1840, 1846) gave among dipteran families the "Cecidomyinae" and "Lestreminae". Rübsaamen (1892) divided the family Cecidomyidae into three subfamilies, viz, Cecidomyidae, Heteropezinae and Lestreminae. This system was used up to the middle of the 20th century (Kieffer 1913; Felt 1925; Rübsaamen & Hedicke 1925–1939). Some authors raised them to family rank in the superfamily Cecidomyiidea (Hennig 1954; Rohdendorf 1964). Kertész (1902) corrected the name to Cecidomyiidae. Bezzi (1908) followed by Felt (1911) for the first time used the name Itonididae (Cecidomyiidae). Möhn (1955), on the basis of his studies of larvae, raised the subertribe Porricondylidi to the subfamily Porricondylinae and divided the family in two subfamilies, viz. Itonidinae (Cecidomyiinae) and Porricondylinae. Pritchard (1960) disbanded the subfamily Heteropezinae and redistributed its components among two of the other subfamilies: the tribes Miastorini and Heteropezini in the subfamily Lestremiinae and the tribe Leptosynini in the subfamily Cecidomyiinae. Mamaev (1964) transferred the tribe Leptosynini to the subfamily Lestremiinae. Wyatt (1967) again merged these groups (Miastorini, Hetropezini, Leptosynini) into one tribe, the Heteropezini, and placed this reinstated tribe in the Lestremiinae, and Parnell (1967) later dealt with the Porricondylinae. Harris (1966) and Gagné (1968) divided the family into Lestremiinae, Porricondylinae and Cecidomyiinae and this system has been usually used until now. The tribal groupings used in the Lestremiinae are taken from Pritchard (1947, 1948, 1951, 1958, 1960), Edwards (1938), Mamaev (1964, 1968), Kleesattel (1979) and Jaschhof (1998), in the Porricondylinae from Panelius (1965) and Parnell (1971), and in the Cecidomyiinae from Rübsaamen & Hedicke (1925–1939), Harris (1966), Mamaev (1968), Grover (1970, 1979), Gagné (1975, 1976, 1994) and Skuhravá (1986, 1997). Recently Jaschhof (2000) separated a species-poor group of ancient gall midges, formerly classified as a tribe of the subfamily Lestremiinae, as an independent subfamily, Catotrichinae.

At the beginning of the 20th century, the known extant Cecidomyiidae of the world contained about 1100 described species in 90 genera (Kertész 1902) and the fossil fauna contained about 30 species (Meunier 1902). Kieffer (1913) in his account of the Cecidomyiidae in *Genera Insectorum* listed about 2500 species in 300 genera described up to that that time from all the world. During the second half of the 20th century several regional catalogues appeared. Foote (1965) summarized the Cecidomyiidae of the Nearctic, Gagné (1968a) of the Neotropical, Gagné (1973) of the Indomalayan (Oriental), Harris (1980) of the Afrotropical, Skuhravá (1986) of the Palaearctic and Gagné (1989a) of the Australasian and Oceanian Regions. Fossil species discovered in various biogeographical regions were compiled by Evenhuis (1994). Before the end of the 20th century, the total estimates of the Cecidomyiidae were 4600 species (Gagné, 1989) and 5300 species (Skuhravá, 1997). Gagné (2004) in his catalog of the Cecidomyiidae of the world lists 5451 species in 598 genera.

The family Cecidomyiidae is here divided in four subfamilies and many subordinate taxonomical groups as shown in Table 1. Comments on each group include a short history of the group, numbers of living species occurring in the biogeographical regions and their biology, numbers of fossil species recorded and also notes on some interesting species.

Subfamily Catotrichinae

The Catotrichinae, with only one tribe (Catotrichini) was established by Edwards (1938). It includes only one genus, *Catotricha* Edwards, 1938. Jaschhof (2000) reclassified this group as a subfamily. Up to the end of 2003 seven species of this genus were known. Three of these occur in the Palaearctic Region, two in the Nearctic Region and one species in the Austral-Oceanian Region. The biology of these gall midges is completely unknown: all adults were caught. One fossil species, *Catotricha mesozoica* Kovalev, 1990, was found in copal in Transbaikalia (Siberia) from the Upper Jurassic–Lower Cretaceous. It is the oldest fossil gall midge species which lived about 100–150 million years ago (Kovalev 1990).

Subfamily Lestremiinae

The subfamily Lestremiinae was created by Rondani (1840) for eight genera, viz. *Lestremia*, *Micromyia*, *Neurolyga*, *Zigoneura*, *Mimosciara*, *Catocha*, *Anarete* and *Sciara*. Many researchers contributed to the knowledge of this group, mainly Winnertz (1870), Kieffer (1898, 1913) and Edwards (1938). Kleesattel (1979) revised this group and studied the phylogenetic relationships of its genera. He divided the subfamily into two supertribes, the Lestremiidi and the Micromyiidi. In the supertribe Lestremiidi he ranged the tribes Catotrichini, Catochini and Lestremiini, in the supertribe Micromyidi the tribes Micromyini, Campylomyzini, Acoenoniini, Strobliellini and a new tribe, the Peromyiini. He came to the conclusion that the subfamily Lestremiinae is a monophyletic group. Jaschhof (1998) based on his revision of the subfamily Lestremiinae of the Holarctic re-evaluated the morphological characters of the adult stage and made many changes at both specific and generic levels. He considered the Lestremiinae to be a paraphyletic group comprising the most primitive gall midges. Later Jaschhof (2000) removed the tribe Catotrichini and reclassified it as a separate subfamily.

Larvae of this subfamily are mycophagous and saprophagous. They develop in decaying wood, in soil, manure and in mushrooms. The biology of many species that are known only from caught adults is completely unknown.

From the point of view of species richness, the Lestremiinae are the smallest subfamily of Cecidomyiidae. Kieffer (1913) gave 193 species in 33 genera descibed at that time. Up to the end of 1982, 194 species in 36 genera had been described in the Palaearctic Region (Skuhravá, 1986). In the period 1983–1994 many new species were described in this region and, as a result, Mamaev (1996) listed 278 species in 38 genera.

By the end of 2003 the subfamily Lestremiinae included 558 species in 59 genera with 410 species in the Palaearctic Region, 88 species in the Nearctic Region about 50 of which have a Holarctic distribution, 7 species in the Afrotropical Region, 65 species in the Indomalayan Region, and 43 species in the Australasian and Oceanian Region. Many species occur simultaneously in Palaearctic, Nearctic and other regions, and are cosmopolitan. Such wide distributions, together with primitive morphological characters, is considered to be good evidence of the very old phylogenetical age of this group. 18 species have been discovered as fossils.

Lestremiinae are divided here into twelwe tribes which are listed in alphabetical order.

Tribe Acoenoniini

The tribe Acoenoniini was established by Pritchard (1960) for one monotypic genus, *Acoenonia*, based on a North American species, *A. perissa* Pritchard, 1947. Later representatives of this genus were also discovered in the Palaearctic Region. By the end of 2003, 4 species in one genus were known. Three species were found in the Palaearctic region and two in the Nearctic Region. *Acoenonia nana* Meyer & Spungis, 1994, occurs in both regions and has a Holarctic distribution. Larvae develop in decomposing detritus (Mamaev & Krivosheina 1965).

Tribe Aprionini

The tribe Aprionini was established by Jaschhof (1998) to include three genera, viz. *Aprionus*, *Mycophila* and *Tekomyia*, that formerly were members of the tribe Micromyini. At the end of 2003 Aprionini contained 112 species in 4 genera. Most species (103) occur in the Palaearctic region, 11 species in the Nearctic Region, 2 species in the Indomalayan and one species in the Australasian and Oceanian regions. Larvae live in decaying wood, in soil and in forest litter. Adults fly abundantly in forests. One fossil species *Aprionus admirandus* Fedotova, 2004 was discovered in Rovno amber (Ukraine) from Late Eocene (Perkovsky & Fedotova 2004).

Tribe Baeonotini

The tribe was established by Gagné (1981) for an apterous female with strange characters – greatly reduced thorax, head with single-faceted eyes and very developed abdominal part. Only one species is known, *Baeonotus microps* Byers, 1969. The biology is unknown, the female was obtained from a Berlese funnel extraction of soil sample of leaf litter in montane oak forest in Virginia, USA, in 1961. Since that time this species has not been found. Byers (1969) originally placed this genus in a separate family, Baeonotidae.

Tribe Bryomyiini

The tribe Bryomyiini was established by Berest (1993). She included originally five genera, viz. *Bryomyia*, *Heterogenella*, *Skuhraviana* and two new genera, *Tomonomyia* and *Cervuatina*. Jaschhof (1998), based on revision of original material, synonymized the last two genera with the older genera. At the end of 2003 this group included three genera: *Bryomyia*, *Heterogenella and Skuhraviana*, with 27 species occurring in the world. The majority (25 species) occur in the Palaearctic region, four species in the Nearctic region (three of which have a Holarctic distribution) and one species is known from the Indomalayan region. Larvae develop in moss, rotting bark and in wood of broad-leaved trees. Adults fly mainly in forests. One fossil species *Heterogenella sparsa* Fedotova, 2004 was discovered in Rovno amber (Ukraine) from the Late Eocene (Perkovsky & Fedotova 2004).

Tribe Campylomyzini

The tribe Campylomyzini was established by Kieffer (1898) for a group that he called Campylomyzides in which he ranked nine genera with 57 species. Enderlein (1936) even treated this group as an independent family. Edwards (1938) gave this group tribal rank. At the end of 2003 59 species in 7 genera were known. Most species (47) occur in the Palaearctic, 12 species in the Nearctic, one in the Indomalayan and 21 species in the Australasian and Oceanian regions. Some species have Holarctic or cosmopolitan distributions. Larvae develop mainly in rotting or rotted vegetable remains (Mamaev & Krivosheina 1965). Adults have vernal and autumnal seasonal activities. Three fossil species have been discovered. *Campylomyza monilifera* Loew, 1850 and *C. crassitarsis* Meunier, 1904, were found in amber of the Baltic Region and originate from the Eocene–Oligocene, and *Cretocordylomyia quadriseries* Gagné, 1977, was discovered in amber in Canada and originates from the Upper Cretaceous (Gagné 1977).

Tribe Catochini

The tribe Catochini was established by Edwards (1938) for four genera, viz. *Catocha*, *Neocatocha*, *Eucatocha* and *Catarete*. Jaschhof (1998) synonymized *Eucatocha* with *Catocha*. At the end of 2003 12 species of 5 genera were known to occur in the world of which 4 species occur in the Palaearctic, 6 species in the Nearctic and 2 species in the Indomalayan region. Larvae are mycophagous and live in moss and forest litter (Mamaev & Krivosheina 1965). Adults occur mostly in meadows or in forests and have typical vernal and autumnal activity periods (Meyer, 1984). Two fossil species are known. *Catocha tenella* Loew, 1850, of uncertain distribution, and *Cretocatocha mcalpinei* Gagné, 1977, which was discovered in amber in Canada and originates from the Upper Cretaceous.

Tribe Forbesomyiini
The tribe was established by Pritchard (1960) for only one species, *Forbesomyia atra* Malloch, 1914. Only females are known. They were found in North America. The wing venation resembles that of *Scatopse* but other morphological features show the relationship with Lestremiinae. Biology is not known, adults were caught in the wild and at a window.

Tribe Lestremiini
The tribe Lestremiini was created by Kieffer (1898) for three genera, viz. *Lestremia*, *Catocha* and *Tritozyga* which together contained 11 species. By the end of 2003 this tribe contained 89 species in 10 genera. They are distributed unevenly in all biogeographical regions, some occuring in two or more regions; 39 species occur in the Palaearctic region, 24 species in the Nearctic, 4 species in the Neotropical, 3 species in the Afrotropical, 27 species in the Indomalayan and 6 species in the Australasian and Oceanian regions. Larvae live on fungi in the soil, in litter and on decaying wood. Two fossil species were discovered of which *Lestremia pinites* Meunier, 1904, was found in amber in the Baltic Region from the Eocene–Oligocene (Meunier, 1904) and *Conarete laesus* Fedotova, 2004 in Rovno amber (Ukraine) from the Late Eocene (Perkovsky & Fedotova 2004).

Tribe Micromyini
The tribe Micromyini was created by Rondani (1856) as "Micromyna" originally for six genera, viz. *Micromya*, *Yposatoea*, *Catocha*, *Anarete*, *Campylomyza* and *Neurolyga*. Some genera were later removed and some provided the basis for establishment of new taxonomic groups. Jaschhof (1998) reorganized the tribe Micromyini, separated the genera *Aprionus*, *Mycophila* and *Tekomyia* into a new tribe – the Aprionini, and made many changes both at genus and species levels. He synonymized many species and genera and described new taxa. At the end of 2003 99 species in 9 genera were included in this tribe. 65 species occur in the Palaearctic and 16 in the Nearctic region (ten of which have a Holarctic distribution), 3 species occur in the Neotropical, 2 species in the Afrotropical and 28 species in the Indomalayan region (Jaschhof & Hippa 1999 a, b). Larvae of known species develop in soil, in litter and in decaying wood (Mamaev, 1963). Two fossil species have been discovered, viz. *Monardia submonilifera* Meunier, 1904, in amber of the Baltic Region from the Eocene–Oligocene and *Micromya convoluta* Fedotova, 2004 in Rovno amber (Ukraine) from the Late Eocene (Perkovsky & Fedotova 2004).

Tribe Peromyiini
The tribe Peromyiini was created by Kleesattel (1979) for two genera, *Peromyia* and *Skuhraviana*. Berest (1993) transferred the genus *Skuhraviana* into a new tribe, Bryomyiini, and discussed a new approach to the classification of this tribe (Berest 1994). At the end of 2003 Peromyiini were the most species rich tribe in the subfamily Lestremiinae. They include 125 species in 2 genera. 114 species occur in the Palaearctic region, 9 species in the Nearctic, one species in the Neotropical and one species in the Indomalayan region. Larvae develop in holes in decaying bark of felled trunks, in layers of decaying wood of broad-leaved trees, in moss, in mycelium covering decaying wood and in forest litter (Mamaev & Krivosheina 1965). Five fossil species have been discovered of which *Peromyia monilifera* Loew, 1850, was found in amber in the Baltic Region from the Eocene–Oligocene and four species of the genus *Peromyia* in Rovno amber (Ukraine) from Late Eocene (Perkovsky & Fedotova 2004).

Tribe Pteridomyiini

The tribe was established recently by Jaschhof & Jaschhof (2003) for two genera, *Pteridomyia* and *Pseudomonardia*, including 13 species. All occur in New Zealand.

Tribe Strobliellini

The tribe Strobliellini was created by Kieffer (1898) for one monotypic genus, *Strobliella*. By the end of 2003 8 species in 5 genera were known. *Strobliella intermedia* Kieffer,1898, discovered in Europe, was found also in Alaska, USA (Jaschhof, 1998) and has a Holarctic distribution. Nothing is known about the biology of these gall midges. One fossil species, *Eltxo cretaceus* Arillo & Nel, 2000, was discovered in Spanish amber from the Lower Cretaceous (Arillo & Nel, 2000).

Unplaced genera of Lestremiinae

Seven monotypic genera, viz. *Calospatha*, *Ipomyia*, *Lithomyza*, *Stenospatha*, *Tricampylomyza*, *Trichelospatha*, and *Tricolpodia*, are insufficiently known, it is therefore not possible to place them in any of the above tribes. One fossil species, *Lithomyza condita* Scudder, 1877, was found in copal in the Nearctic Region from the Eocene. Gagné (2004) excludes *Lithomyza* from Cecidomyiidae.

Subfamily Porricondylinae

This subfamily was established by Kieffer (1898) originally as “Epidosides” to include 12 genera known in Europe and Algeria at that time. In 1913 he changed the name to Porricondylariae and included 26 genera containing a total of 188 species. Rübsaamen & Hedicke (1925–1939) treated this group as a supertribe of the subfamily Cecidomyiinae and divided it into three tribes, the Diallactini, Asynaptini and Porricondylini. Enderlein (1936) first gave this group the rank of subfamily and divided it into two tribes, the Holoneurini and the Porricondylini, comprising a total of 14 genera occurring in Central Europe. Möhn (1955) was the first to make a detailed study of the larvae. He did not divide the subfamily into tribes but gave very detailed diagnoses of the larvae of European genera and species with figures of the main morphological characters. He considered this subfamily as a link between the Lestremiinae and Cecidomyiinae. Panelius (1965), in his revision of the Palaearctic Porricondylinae, divided this subfamily into five tribes, the Diallactini, Porricondylini, Asynaptini, Winnertziini and Leptosynini, with a total of 31 genera containing 204 species described in Europe. He considered that the Porricondylinae are a paraphyletic group. Mamaev (1968) treated this group as a tribe and divided it into nine subtribes, viz. Diallactina, Winnertziina, Asynaptina, Dicerurina, Dirhizina, Holoneurina, Bryocryptina, Solntseviina and Porricondylina. Parnell (1971), in his revision of the Nearctic Porricondylinae, divided this subfamily into eight tribes. He included in the Heteropezini genera that had previously been included in other subfamilies. Mamaev (1990) accepted this group as a subfamily and divided the Palaearctic genera into ten tribes. He dissolved the former Holoneurina, incorporated the genus *Holoneurus* Kieffer, 1895 in the Porricondylini and also ranked in this subfamily the tribes Heteropezini and Leptosynini, which he had earlier considered to be a part of the subfamily Lestremiinae. Later Mamaev (2001) established the tribe Holoneurini for six genera previously included in the Porricondylini.

Larvae of Porricondylinae are mycophagous and saprophagous. They develop in decaying organic matter or are associated with fungi developing on branches or under the bark of trees. Larvae of several species and genera develop in cones of coniferous trees. The biology of many species which were caught as adults is completely unknown.

By the end of the year 2003 the subfamily Porricondylinae included 647 species in 90 genera occurring in all biogeographical regions of the world. 426 species occur in the Palaearctic Region, 89 species in the Nearctic Region (of which 7 species have a Holarctic distribution), 9 species in the Neotropical Region, 17 species in the Afrotropical Region, 48 species in the Indomalayan

Region and 28 species in the Australasian and Oceanian Regions. A relatively large number of fossil species (38 species in 22 genera) have been discovered in fossil amber and copal in various parts of the world, which indicates the geological age of this group. They are mentioned under relevant tribes.

The Porricondylinae are divided here into ten tribes which are listed in alphabetical order.

Tribe Asynaptini

The tribe Asynaptini was created by Rübsaamen & Hedicke (1925–1939) for four genera, viz. *Asynapta*, *Clinorhytis*, *Winnertzia* and *Winnertziola*. Panelius (1965) revised and reorganized this group. He separated the genus *Winnertzia* to form an independent tribe, the Winnertziini. In the tribe Asynaptini he included four genera, viz. *Asynapta*, *Camptomyia*, *Colomyia* and *Parasynapta*. Two genera, *Asynapta* and *Camptomyia*, were revised by Spungis (1988, 1989). By the end of 2003 the Asynaptini contained 137 species in 10 genera which are distributed in all biogeographical regions of the world. 82 species occur in the Palaearctic, 22 species in the Nearctic, 5 species in the Neotropical, 9 species in the Afrotropical, 15 species in the Indomalayan and one species in the Australasian and Oceanian regions. Larvae are usually associated with wood of old trees and develop in dead wood, under the bark of various broad-leaved and coniferous trees. They are also found inside burrows made in trees by beetles of the family Curculionidae; under the leaf sheaths of *Calamagrostis*, *Carex* and *Hordeum*; in the cones of *Picea excelsa* and in galls of *Lipara lucens* on *Phragmites australis* (*P. communis*). The biology of many species is unknown. Four fossil species, viz. *Camptomyia sinuosa* Meunier, 1904, one unidentified species of *Colomyia* and two species of *Asynapta* were found in amber of the Baltic Region from the Eocene–Oligocene.

Tribe Bryocryptini

Mamaev (1966) created the subtribe Bryocryptina for only one genus, *Bryocrypta*. Skuhravá (1986) raised it to Bryocryptini. At the end of 2003 13 species of one genus had been described of which 7 species occur in the Palaearctic region and one species in the Indomalayan Region. Larvae of *Bryocrypta dubia* Kieffer, 1896 develop among moss and the biology of other species is unknown. Five fossil species of the genus *Bryocrypta* were discovered in amber of the Baltic Region originating from the Eocene–Oligocene (Meunier 1904).

Tribe Diallactini

The tribe Diallactini was created by Rübsaamen & Hedicke (1925–1939) for only one genus, *Diallactes*. Enderlein (1936) treated this group as a subfamily of the family Campylomyzidae with two tribes, the Diallactini and Asynaptini. Panelius (1965) gave a modern definition of Diallactini as a tribe of the subfamily Porricondylinae and revised genera and species belonging to this tribe. By the end of 2003 31 species in 6 genera were known. Of these 18 species occur in the Palaearctic, 3 species in the Nearctic, 3 species in the Neotropical, 1 species in the Afrotropical, 3 species in the Indomalayan and one species in the Australasian and Oceanian regions. Larvae live in decaying wood and trunks of trees, under the bark of forest trees covered by mycelium or in forest litter. Adults were caught mainly in broad-leaved forests (Panelius, 1965, Spungis, 1985). The biology of many species is completely unknown. Two fossil species were discovered. *Haplusia eocenica* (Meunier, 1904) (*Palaeocolpodia eocenica*) in Baltic amber and *Cretohaplusia ortunoi* Arillo et Nel, 2000, in the Lower Cretaceous amber of Alava in northern Spain.

Tribe Dicerurini

Mamaev (1966) recognized the morphological similarities of four genera, viz. *Dicerura*, *Tetraneuromyia*, *Hilversidia* and *Synepidosis*, which he combined in the subtribe Dicerurina. Parnell (1971) raised this group to the tribe Dicerurini. At the end of 2003 the tribe included 45 species in 10 genera. The majority of them – 37 species – occur in the Palaeartic Region and only 8 species in the Neartic Region. Larvae develop in decaying wood of forest trees, among decaying leaves, in mycelium covering decaying trunks, under the sheaths of *Iris pseudocarus*, *Scirpus silvaticum* or in forest litter. The biology of many species is unknown (Spungis, 1987).

Tribe Dirhizini
Mamaev (1966) created the subtribe Dirhizina for one monotypic genus, *Dirhiza*. Parnell (1971) raised this group to tribal level. By the end of 2003 only 4 species in one genus were known, of which two species occur in the Palaearctic and one species in the Nearctic region. Their biology is unknown. One fossil unidentified species of the genus *Dirhiza* was discovered in amber of the Baltic Region from the Eocene–Oligocene (Loew 1850).

Tribe Heteropezini
In this group are included gall midges with simplified morphological characters in the adult stage and with larvae which reproduce paedogenetically. This group have been treated differently by various researchers. Schiner (1868) originally established a subfamily, Heteropezinae, for the single genus, *Heteropeza*. Rübsaamen (1892) included in this subfamily four genera, viz. *Heteropeza*, *Oligarces*, *Miastor and Monodicrana* (fossil), and Kieffer (1913) listed ten genera with 24 species. Enderlein (1936) raised this group to family rank, the Heteropezidae, with four subfamilies, viz. Oligarcinae, Heteropezinae, Miastorinae and Leptosyninae. Hennig (1948) treated this group as a family within the superfamily Itonidoidea. Möhn (1960), based on similarity of morphological character of larvae and on their paedogenesis, recommended inclusion of the subfamily Heteropezinae in the subfamily Lestremiinae. Pritchard (1960) reclassified the paedogenetic genera of North America and divided them into three tribes, placing the Heteropezini and Miastorini in Lestremiinae and the Leptosynini in Cecidomyiinae. Panelius (1965) included the tribe Leptosynini with *Leptosyna*, *Henria*, *Frirenia*, *Nikandria and Brittenia* in the family Porricondylinae. Wyatt (1967) joined the tribes Leptosynini, Miastorini and Heteropezini into one tribe, the Heteropezini, and placed it in the subfamily Lestremiinae. Mamaev (1968) classified this group as the tribe Heteropezini, placed it at the beginning of the subfamily Cecidomyiinae and divided it into three subtribes, the Leptosynina, Miastorina and Heteropezina. Parnell (1971) reclassified this group and considered it as one tribe of the subfamily Porricondylinae. Mamaev (1990) divided genera into two tribes, the Heteropezini and Leptosynini, and placed them in the subfamily Porricondylinae.

By the end of 2003 the Heteropezini included 31 species in 14 genera which are distributed in all biogeographical regions of the world, with the exception of the Neotropics. 13 species occur in the Palaearctic region, 6 species in the Nearctic region (3 species with a Holarctic distribution), one species in the Afrotropical, one species in the Indomalayan and 6 species in the Australasian and Oceanian regions. Paedogenetic larvae live in decaying plant detritus and feed by sucking on fungal mycelia under decaying bark of broad-leaved trees. *Heteropezina cathistes* Pritchard, 1960 has a very peculiar biology. Pritchard (1960) described this species based on a female which was combed from the fur of a Norway rat in an old frame barbershop at Tampa, Florida, USA, in 1945. Mamaev (1964) and Spungis (1979) found adults of this species outdoors in the western part of the Palaeactic Region.

Ten fossil species of this group have been discovered and two of them are extant. *Frirenia eocenica* Meunier, 1904, *Heteropeza pulchella* Meunier, 1904, *Meunieria succini* Felt, 1911, *Monodicrana terminalis* Loew, 1850, were found in fossil amber of the Baltic Region from the Eocene–Oligocene, *Palaeospaniocera paleospaniocera* Evenhuis, 1994, in African copal. *Leptosyna nervosa* Winnertz, 1853, and *Miastor metraloas* Meinert, 1864, which are both extant, were found in fossil amber of the Baltic Region. Three other species were discovered in other regions, viz.

Neostenoptera kiefferi Meunier, 1901, in copal of the Afrotropical Region from the Holocene, *Cretomiastor ferejunctus* Gagné, 1977, in fossil amber in Canada from the Upper Cretaceous, and one unidentified species of the genus *Henria* in fossil amber in Mexico from the Oligocene–Miocene (Gagné 1973).

Tribe Holoneurini

The tribe Holoneurini was established by Mamaev (2001) for genera previously included in the Porricondylini. By the end of 2003 this tribe included 32 species in 6 genera. 24 species were discovered in the Palaearctic region, 4 species in the Nearctic, 1 species in the Neotropical, 2 species in the Indomalayan and one species in the Australasian and Oceanian regions. Larvae develop under the bark of dead trees and among mouldy leaves. The biology of most species is unknown.

Tribe Porricondylini

This is the most species rich tribe of this subfamily. The tribe was established by Rübsaamen & Hedicke (1925–1939). Enderlein (1936) included in this group ten genera some of which were later included in other groups. Panelius (1965) included 12 genera in the tribe and Mamaev (1964, 1966, 1986, 1990) made important contributions to knowledge of this group, establishing 17 new genera and describing many new species.

By the end of 2003 the tribe contained 217 species in 30 genera which are distributed in all biogeographical regions of the world with the exception of the Neotropical region. 130 species occur in the Palaearctic region, 33 species in the Nearctic, 5 species in the Afrotropical, 21 species in the Indomalayan and 19 species in the Australasian and Oceanian regions. The biology of most species is unknown, adults (sometimes only one specimen) were caught in the wild. Larvae of known species develop in decaying or decayed wood, under the bark of forest trees, among decaying leaves and in forest litter. The genus *Porricondyla* is the species-rich, containing 116 species. Ten fossil species were discovered in amber in the Baltic Region from the Eocene–Oligocene, viz. three species of *Colpodia*, one species of *Palaeocolpodia* and six species of *Porricondyla*, all described by Meunier (1904).

Tribe Solntseviini

Mamaev (1966) established the subtribe Solntseviina for only one monotypic genus, *Solntsevia*. Later he described another genus, *Grisepidosis*, and incorporated it in this group (Mamaev, 1968). Parnell (1971) raised this group to tribal level. By the end of 2003 5 species in 2 genera were known of which four species occur in the Palaearctic region and one species in the Nearctic region. Larvae of the Palaearctic species, *Solntsevia nigripes* Mamaev, 1965, develop in decaying trunks of *Picea excelsa* and larvae of *Grisepidosis bilobata* Mamaev, 1968 develop in mycelium covering bark of *Ulmus*-trunks.

Tribe Winnertziini

The tribe Winnertziini was established by Panelius (1965) for three genera, *Winnertzia*, *Trichoxylomyia* and *Rhipidoxylomyia*. Spungis (1992) revised genera and species of this tribe, made several changes and revived the genus *Clinorrhitis* which had been synonymized with *Winnertzia* by Panelius (1965).

By the end of 2003 the Winnertziini contained 129 species in 8 genera. 108 species occur in the Palaearctic region, 11 species in the Nearctic, one species in the Afrotropical and 3 species in the Indomalayan regions. Larvae develop in decaying wood, under the bark of trunks of broad-leaved and coniferous trees, among fungal mycelia covering decaying wood, in stem bases of *Phleum* and in cones of coniferous trees. The biology of many species is unknown. Six fossil species are known. *Cretowinnertzia angustala* Gagné,1977, was discovered in amber in Canada from the Upper Cretaceous. Five species of the genus *Winnertzia* are known from fossils. Four of them, all described by Meunier (1904), were found in amber of the Baltic Region from the Eocene–Oligocene, and one species, *Winnertzia burmatica* Cockerell, 1917, was discovered in amber in Myanmar in the Indomalayan Region from the Miocene.

Uncertain systematic position

The systematic position of two genera, *Brephometra* Strand, 1910 (= *Meinertomyia* Felt, 1911) and *Rabindrodiplosis* Grover, 1964, is not quite clear for lack of information.

Subfamily Cecidomyiinae

The Cecidomyiinae, established as a subfamily by Rondani (1840), is the largest group of Cecidomyiidae. It includes three biological groups of gall midges. Larvae of the phytophagous group (it is the largest group) cause galls on host plants or develop on plant organs without inducing galls. Larvae of the mycophagous group are associated with fungi. Larvae of the zoophagous group are adapted to feeding on other gall midge larvae, on other small insects and on other small arthropods. The biology of many species that are known only from caught adults remains completely unknown.

Kieffer (1898) divided the subfamily Cecidomyiinae into four groups, viz. Lasiopterinae, Asphondylides, Diplosinae and Epidosides, which included about 600 species described from Europe and Algeria at that time. Later Kieffer (1913) in his summary of gall midges described worldwide, divided the subfamily into six groups; recognised Oligotrophariae and Brachyneurariae and recorded 2500 species in 300 genera. Rübsaamen & Hedicke (1925–1939) adapted Kieffer´s system, introduced the category of supertribes for Kieffer´s groups and divided each supertribe into smaller categories, the tribes. Harris (1966) enriched the supertribe Cecidomyiidi with three tribes, the Lestodiplosini, Aphidoletini and Mycodiplosini, and Gagné (1975a) established the supertribe Stomatosematidi. Skuhravá (1986) divided this subfamily into four supertribes which contained a total of 1464 species in 214 genera occurring in the Palaearctic Region. Gagné (1986, 1989b) reclassified this subfamily and included the supertribe Asphondyliidi as a tribe under the Cecidomyiidi. Gagné (1994) established a new supertribe, Brachineuridi, and two new tribes, Centrodiplosini and Lopesiini. Cecidomyiinae are divided here into six supertribes which are listed in alphabetical order. Each of them is divided into tribes which are also listed in alphabetical order.

By the end of 2003 the subfamily Cecidomyiinae included 4179 species in 463 genera which are distributed in all biogeographical regions of the world. 2180 species occur in the Palaearctic region, 993 species in the Nearctic (about 30 of them with a Holarctic distribution), 479 species occur in the Neotropical, 170 species in the Afrotropical, 285 species in the Indomalayan and 110 species in the Australasian and Oceanian regions. A relative low number of fossils, only 30 species in 17 genera, seems to give evidence that the group is relatively young from the phylogenetical point of view. Adults of some genera were preserved in fossil amber and copal and galls of some species were discovered as impressions on fossil leaves of various trees. Fossil species are mentioned under relevant tribes.

Supertribe Asphondyliidi

The supertribe Asphondyliidi was established by Rübsaamen & Hedicke (1925–1939). Möhn (1961) made important contributions to knowledge of this group mainly with his study of the Neotropical fauna. Gagné (1989a) treated this supertribe as a tribe of Cecidomyiidi to reflect its close relationship to the plant-feeding members of the supertribe Cecidomyiidi.

By the end of 2003 the Asphondyliidi included 459 species in 43 genera that occur in all biogeographical regions of the world. It is interesting that no fossil species and no species with a

Holarctic distribution are known. 114 species occur in the Palaearctic Region, 114 in the Nearctic, 155 in the Neotropical, 33 in the Afrotropical, 39 in the Indomalayan and 15 species in the Australasian and Oceanian regions. All Asphondyliidi are gall makers. This group is divided here into three tribes which are treated here in alphabetical order.

Tribe Asphondyliini

The tribe was created by Rübsaamen & Hedicke (1925–1939). This is the largest tribe of Asphondyliidi. By the end of 2003 308 species in 18 genera had been described. 73 species occur in the Palaearctic region, 78 species in the Nearctic, 109 species in the Neotropical, 21 species thein Afrotropical, 17 species in the Indomalayan and 10 species in the Australasian and Oceanian regions. Most species occur in the Nearctic and Neotropical regions. The most speciose genus, *Asphondylia*, contains 270 species and is cosmopolitan. Other genera are scattered in all biogeographical regions. All species are gall makers. Three species of the genus *Asphondylia* are serious pests of cultivated plants in the Palaearctic, viz. *A. capparis* Rübsaamen, 1893, on flower buds of *Capparis spinosa*, *A. gennadii* Marchal, 1904, on pods of *Ceratonia siliqua* and *A. miki* Wachtl, 1880, on pods of *Medicago sativa* (Darvas et al. 2000).

Tribe Polystephini

The tribe Polystephini was established by Möhn (1961) for two genera, viz. *Polystepha* and *Turkmenomyia* (now: *Kochiomyia*). Gagné (2004) considered this group to be a part of the subtribe Schizomyiina of the tribe Asphondyliini.

By the end of 2003 this group contained 41 species in 4 genera. 17 species occur in the Palaearctic region, 19 species in the Nearctic, 2 species in the Neotropical and 3 species in the Indomalayan region. All species are gall makers.

Tribe Schizomyiini

The tribe Schizomyiini was established by Rübsaamen & Hedicke (1925–1939) for three genera, viz. *Schizomyia*, *Kiefferia* and *Placochela*. Möhn (1961) included in this group 12 genera. Gagné (2004) treated this group it as a subtribe Schizomyiina of the tribe Asphondyliini.

By the end of 2003 this group contained 120 species in 21 genera which are distributed in all biogeographical regions of the world. 23 species occur in the Palaearctic region, 17 species in the Nearctic, 44 species in the Neotropical, 12 species in the Afrotropical, 19 species in the Indomalayan and 4 species in the Australasian and Oceanian regions. All species of this tribe are gall makers. The genus *Schizomyia* including 47 species has a cosmopolitan distribution. A polyphagous species *Kiefferia pericarpiicola* (Bremi, 1847) inducing fruit galls on various host plant species of the family Apiaceae has a large distribution area in the Palaearctic Region.

Supertribe Brachineuridi

Kieffer (1913) established a heterogenous group called "Brachyneurariae" in which he included 44 species of 22 genera. Rübsaamen & Hedicke (1925–1939) took over his conception but changed its name into Brachyneurini. Several genera were later transferred into other groups. Möhn (1955) characterized this group as a collection of genera that do not fit into other groups. Gagné (1994) studied this group in detail, rearranged it and evaluated it as a supertribe Brachineuridi with five genera occurring mainly in the Neotropics.

By the end of 2003 this supertribe with only one tribe Brachineurini contained 50 species in 7 genera which are distributed in all biogeographical regions with exception of the Afrotropics. 33 species occur in the Palaearctic region, 13 species in the Nearctic, one species in the Neotropical, one species in the Indomalayan and two species in the Australasian and Oceanian regions. The biology of most species is unknown. Adults of many species were caught in wild and is not known where their larvae develop. On the other hand it is known that larvae of *Brachineura fungicola* (Mamaev, 1967) develop in mushrooms on dry tree branches, larvae of *Brachyneurina peniophorae* Harris, 1979 are associated with the fungus *Peniophora cinerea* (Fr.) Cooke and larvae of *Prolauthia circumdata* (Winnertz, 1853) live as inquilines in the galls of *Dasineura crataegi* (Winnertz, 1853) on *Crataegus oxyacantha* L. Adults of the genus *Rhizomyia* seem to be xylophilous, some were caught on rotten wood, other were reared from a litter or the biology is completelly unknown.

Supertribe Cecidomyiidi

The supertribe Cecidomyiidi is the largest group of the subfamily Cecidomyiinae. It was established by Rübsaamen & Hedicke (1925–1939). It is the most species rich group of this subfamily and includes species with diverse morphological characters and varied biology. Most species are gall makers, some species are zoophagous and others are mycophagous. The biology of many other species remains unknown. Gagné (1973) reviewed the Nearctic genera and species and Harris (1966) dealt with species and genera of economic importance. Gagné (1989b) divided the Nearctic Cecidomyiidi into six tribes, the Neotropical genera into nine tribes. Skuhravá (1997) grouped the Palaearctic Cecidomyiidi, based on morphological character of adults, into eight tribes. Gagné (2004) divided the world Cecidomyiidi tentatively in ten tribes, viz. the Anadiplosini, Aphidoletini, Asphondyliini, Cecidomyiini, Centrodiplosini, Clinodiplosini, Hormomyiini, Lestodiplosini, Lopesiini and Mycodiplosini. The supertribe Cecidomyiidi is divided here into eleven tribes some of which do not conform with those recognised by Gagné (2004). They are listed in alphabetical order. Many genera that have not been adequately studied are treated as "Unplaced genera".

By the end of 2003 the supertribe contained 1705 species in 256 genera that are distributed in all biogeographical regions of the world. 824 species occur in the Palaearctic Region, 401 species in the Nearctic (of which 9 species have a Holarctic distribution), 139 species occur in the Neotropical, 111 species in the Afrotropical, 202 species in the Indomalayan and 60 species in the Australasian and Oceanian regions. Only 16 species are known as fossils.

Tribe Anadiplosini

The tribe Anadiplosini is a small group which was created by Gagné (1994) for eight species in five genera the distribution of which is restricted to the Neotropical Region. All species are gall causers.

Tribe Aphidoletini (Bremiini)

Harris (1966) established originally the tribe Aphidoletini for the genera *Aphidoletes* and *Monobremia*, larvae of which are aphidophagous and males have antennae with unregularly prolonged circumfilar loops. Harris (1973) reviewed aphidophagous gall midges and showed an extensive host range of the species *Aphidoletes aphidimyza* (Rondani, 1847) larvae of which feed on more than 60 species of various genera of aphids. I broadened the conception of this group to include all adults with irregular prolonged circumfilar loops in the male antennae (Skuhravá 1997).

By the end of 2003 this group contained 37 species of 9 genera which occur in all biogeographical regions. 15 species occur in the Palaearctic region, 12 species in the Nearctic, 2 species in the Neotropical, 4 species in the Afrotropical, 6 species in the Indomalayan and two in the Australasian and Oceanian regions. *Aphidoletes aphidimyza* (Rondani, 1847), the species of cosmopolitan distribution, is used with success in the biological control of aphids. One fossil unidentified species of the genus *Bremia* was discovered in amber in Mexico from the Oligocene–Miocene (Gagné 1973). Most Aphidoletini are probably zoophagous. Larvae of the genus *Aphidoletes* are aphidophagous feeding on aphids. Some species the adults of which were caught on logs are xylophilous. Larvae of *Bremia legrandi* Harris, 1981, occurring in Gabon (Central Africa) feed on eggs of the dragonfly *Malgassophlebia aequatoris* Legrand (Odonata, Libellulae).

Tribe Cecidomyiini

The tribe Cecidomyiini was established by Rübsaamen & Hedicke (1925–1939). This is a very large group which includes gall making species, several species are inquilines and the biology of many species remains unknown. By the end of 2003 221 species in 42 genera were known. They are distributed in all biogeographical regions of the world. Most species occur in the Palaearctic and Nearctic Regions and a few others are scattered in other regions. 91 species occur in the Palaearctic region, 78 species in the Nearctic, 2 species in the Neotropical, 14 species in the Afrotropical, 27 species in the Indomalayan and 5 species in the Australasian and Oceanian regions. Only one species, *Monarthropalpus flavus* (Schrank, 1776) has a Holarctic distribution. It is an immigrant from Europe in North America (Brewer et al. 1984). *Sitodiplosis mosellana* (Géhin, 1856) is a serious pest of wheat and other cereals in the Holarctic region (Darvas et al. 2000) and has secondarily nearly cosmopolitan distribution. *Plemeliella abietina* Seitner, 1908, is a pest of seed of *Picea abies* in Central Europe (Skuhravá & Roques 2000). Ten fossil species were discovered. Of them, seven species of the genus *Cecidomyia* were found in the amber and copal in various parts of the Palaearctic region, one species in the Nearctic region, all from the Miocene, Oligocene and Eocene. Traces of galls of two species of the genus *Sequoiomyia* were discovered. Traces of galls together with larvae and pupae of *S. kraeuseli* Möhn, 1960, from the cones of the fossil tree *Sequoia langsdorfii* were found in Germany from the Miocene (Möhn 1960b). Traces of galls in the form of swollen seeds caused by *Sequoiomyia taxodii* Felt, 1916, were found in North America from the Pleistocene. This species is extant.

Tribe Centrodiplosini

This small group including three species in three genera was established by Gagné (1994). Larvae cause galls on host plants of the family Solanaceae in Argentina. This group is restricted to the Neotropical region.

Tribe Clinodiplosini

The tribe Clinodiplosini was established by Rübsaamen & Hedicke (1925–1939) for 26 heterogenous genera which were divided into three subtribes, viz. Octodiplosina, Clinodiplosina and Ametrodiplosina. Harris (1966) separated five genera the larvae of which are almost exclusively feeders on fungi in an independent tribe Mycodiplosini based on morphological characters of larvae. I treat here these genera in the tribe Clinodiplosini because I did not find any morphological characters of adults to support the separation into an independent tribe (Skuhravá 1997).

By the end of 2003 this large heterogenous group contained 242 species in 26 genera which are distributed in all biogeographical regions of the world. 94 species occur in the Palaearctic region, 87 species in the Nearctic, 36 species in the Neotropical, 4 species in the Afrotropical, 19 species in the Indomalayan and only one species in the Australasian and Oceanian regions. Larvae of most species are mycophagous or phytosaprophagous developing in decaying plant matter. Larvae of several species are phytophagous and live as inquilines in galls caused by other insects. Only a few species cause galls on host plants of various plant families. Several species of the genus *Resseliella* are pests in agriculture and forestry in the Palaearctic Region. Larvae of *R. piceae* Seitner,1906 damage seed of *Abies alba*, larvae of *R. quercivora* Mamaev, 1965, cause cambium necroses on young oak stems, larvae of *R. oculiperda* (Rübsaamen, 1893) prevent the uniting of the stock with the scion of cultivated roses and fruit trees (Darvas et al. 2000). One fossil unidentified species of the genus *Clinodiplosis* was discovered in amber in Mexico in the Neotropical Region from the Oligocene–Miocene (Gagné 1973).

Tribe Contariniini

The tribe Contariniini was created by Rübsaamen & Hedicke (1925–1939) for 11 genera. Harris (1966) gave a characterization of this tribe and treated species of the genus *Contarinia* of economic importance. Gagné (2004) included genera treated here in the tribe Cecidomyiini.

By the end of 2003 the tribe contained 479 species in 17 genera which are distributed in all biogeographical regions. The majority, 342 species, occur in the Palaearctic region, 85 species in the Nearctic, 13 species in the Neotropical, 15 species in the Afrotropical, 16 species in the Indomalayan and 22 species in the Australasian and Oceanian regions. Most species are gall makers, some live in flower buds without causing galls. The species richest genus *Contarinia* including at present 332 species has a cosmopolitan distribution. About ten species of this genus are pests in agriculture and forestry (Darvas et al. 2000, Skuhravá & Roques 2000). Most species are specifically restricted to their host plants. *Contarinia maculipennis* Felt, 1933, is a polyphagous pest of orchids and other unrelated cultivated plants (Uechi et al. 2003). *Thecodiplosis brachyntera* (Schwägrichen, 1835) is a serious pest of pine stands in Central Europe (Skuhravý 1991). The attack of *Thecodiplosis japonensis* Uchida et Inouye, 1955 may lead to the death of attacked pine trees in eastern Asia. Two fossil species were discovered. One unidenfitied species of *Contarinia* was found in amber in Mexico from the Oligocene–Miocene (Gagné, 1973). The fossil galls identified by Lewis, Heikes & Lewis (1990) as *Thecodiplosis clarkiensis* are correctly galls of *Taxodiomyia cupressiananassa*, an extant species (Gagné 2004).

Tribe Coquillettomyiini

The tribe Coquillettomyiini was established by Mamaev (1968) for two genera having a strange character of the male terminalia. Skuhravá (1967) included in this tribe seven genera of similar character. Gagné (2004) treated these genera under the tribe Mycodiplosini.

By the end of 2003 the tribe contained 100 species in 6 genera which are distributed in all biogeographical regions with the exception of the Australasian and Oceanian regions. Some genera have a cosmopolitan distribution. The majority, 52 species, occur in the Palaearctic region, 21 species in the Nearctic, 3 species in the Neotropical, 2 species in the Afrotropical and 24 species in the Indomalayan Region. The biology of most species is unknown. Adults were caught in the wild.

Tribe Lestodiplosini

The tribe Lestodiplosini was created by Harris (1966) for gall midges the larvae of which are predators of other gall midges and small arthropods. Many species and genera associated with coccids (Coccoidea) are members of this group (Harris 1968). By the end of 2003 the tribe contained 348 species in 25 genera which are distributed in all biogeographical regions of the world. 185 species occur in the Palaearctic region, 75 species in the Nearctic, 22 species in the Neotropical, 25 species in the Afrotropical, 43 species in the Indomalayan and 11 species in the Australasian and Oceanian regions. Most species are widely distributed in two or more regions, as for example *Feltiella acarisuga* (Vallot, 1827), larvae of which prey on tetranychid mites (Gagné 1995). The large genus *Lestodiplosis* including 168 species has a cosmopolitan distribution. Two fossil species were discovered, viz. *Lestodiplosis kiefferis* Meunier, 1905, in copal in Madagascar in the Afrotropical region from the Holocene, and one unidentified species of *Lestodiplosis* in amber in Mexico in the Neotropical region from the Oligocene–Miocene (Gagné 1973).

Tribe Lopesiini

This small group was established by Gagné (1994) for six Neotropical genera. By the end of 2003 the tribe contained 26 species in 11 genera. Four species occur in the Nearctic, 16 species in the Neotropic, 4 species in the Afrotropic and 3 species in the Australasian and Oceanian regions. All species are gall makers. One native Nearctic species – *Obolodiplosis robiniae* (Haldemann, 1847), larvae of which cause galls on leaflets of *Robinia pseudoacacia*, appeared suddendly as an immigrant in Asia and in Europe (Kodoi et al. 2003, Duso & Skuhravá 2004, Skuhravá & Skuhravý 2004).

Tribe Monodiplosini

The tribe Monodiplosini was established by Rübsaamen & Hedicke (1925–1939) for five genera with unusual shape of antennae. The flagellomeres of male and female are cylindrical (gynecoid) with simple circumfilar rings in both sexes. Skuhravá (1997) treated these genera under this group but Gagné (2004) included them under the category of unplaced genera.

By the end of 2003 this tribe contained 11 species in 5 genera. The majority (10 species) occur in the Palaearctic region and one species in the Indomalayan region. Some species are gall causer or are associated with host plants, probably as inquilines, two species are xylophilous and the biology of other is unknown.

Tribe Hormomyiini (Planetellini)

Rübsaamen & Hedicke (1925–1939) originally founded and named this group of genera as Hormomyiini based on the genus *Hormomyia*. They included in this tribe four genera which later fell into synonymy with *Planetella*. The name Planetellini was given by Grover (1979).

By the end of 2003 the tribe contained 81 species in 4 genera. 33 species occur in the Palaearctic region, 22 species in the Nearctic, 4 species in the Afrotropical and 25 species in the Indomalayan Region. Most species are phytophagous and some of them cause galls. The genus *Planetella* includes both species that were caught in the wild, the biology of which is unknown, and also species that induce galls mainly on *Carex* (Cyperaceae) and on some species of Poaceae. Three species are serious pests of cultivated plants, viz. *Haplodiplosis marginata* (von Roser, 1840) of cereals in Central Europe, *Orseolia oryzae* (Wood-Mason, 1889) of rice in south-eastern Asia and *Orseolia oryzivora* Harris & Gagné, 1982 of rice in tropical Africa.

Unplaced species and genera of Cecidomyiidi

In this group by the end of 2003 belonged 149 species in 103 genera which were described in the world. It is not possible to place them in any of the above taxonomical groups because their morphological characters are poorly known. The fossil species *Phyllocecidium liquidambrus* Givulescu, 1984, represented by traces of galls found in Romania in the Palaearctic Region from the Pliocene is included in this group. Some species and genera mentioned in this group will be probably placed in other taxonomical groups when new material will be reared and studied.

Supertribe Lasiopteridi

The supertribe Lasiopteridi was established by Rübsaamen & Hedicke (1925–1939). They divided this supertribe into two tribes, the Alycaulini and the Lasiopterini. Möhn (1955) first expressed the opinion that the Lasiopteridi and the Oligotrophidi are closely related to each other. Möhn (1963, 1964a,b, 1975) contributed importantly to the knowledge of the Neotropical Lasiopteridi. Gagné (1969) divided this supertribe into three tribes, the Alycaulini, the Lasiopterini and the Trotteriini. Gagné (1986) showed the simplified phylogenetic trees of Cecidomyiidae where the Lasiopteridi are divided into seven tribes, viz. Alycaulini, Brachineurini, Dasineurini, Lasiopterini, Ledomyiini, Oligotrophini and Rhizomyiini. Gagné (2004) treated the world genera of Lasiopteridi in nine tribes.

The Lasiopteridi are divided here into four tribes, the Alycaulini, Camptoneuromyiini, Lasiopterini and Trotteriini and are treated below in alphabetical order.

By the end of 2003 the supertribe contained 576 species in 47 genera that are distributed in all biogeographical regions of the world. Most species (246) occur in the Palaearctic region, 146 species in the Nearctic, 142 species in the Neotropical, 11 species in the Afrotropical, 22 species in the Indomalayan and 16 species in the Australasian and Oceanian regions. Two species of the genus *Lasioptera* are known from fossils, one from the Nearctic region from the Eocene and one from the Baltic region from the Eocene up Oligocene. Most members of the supertribe Lasiopteridi are gall makers, some are inquilines which live in galls of other gall midges. In galls of some groups fungal symbionts occur. *Ozirrhincus millefolii* (Wachtl, 1884), developing in swollen seed in flower heads of *Achillea millefolium*, has Holarctic distribution occurring both in the Palaearctic and the Nearctic regions. It is a primarily Palaearctic species which has been introduced in North America probably during colonial times in the seeds of its host plant (Gagné 1989).

Tribe Alycaulini

This tribe was created by Rübsaamen & Hedicke (1925–1939) for only one Neotropical genus, *Alycaulus*. Gagné (1969) revised this tribe and established five new genera. By the end of 2003 the tribe contained 209 species in 19 genera. All occur only in the Nearctic and the Neotropical regions. Most species are gall makers. They induce mainly stem swellings and leaf blister galls on various host plants. Some species are inquilines in galls of other gall midges.

Tribe Camptoneuromyiini

The tribe Camptoneuromyiini was established by Mamaev (1968) for the genus *Campto-neuromyia* with only one European species. Möhn (1975) described several new species from the Neotropical Region. Gagné (1994) reviewed the tribe and included five Neotropic genera.

By the end of 2003 the tribe contained 27 species in 6 genera. The majority, 20 species, occurs in the Neotropic region, 6 species in the Nearctic region and only one species, *Camptoneuromyia petioli* Mamaeva, 1964, larvae of which are inquilines in galls of *Contarinia petioli* (Kieffer, 1898) on leaf stalks of *Populus tremula*, occurs in the Palaearctic region. Most species of this group are inquilines in galls of other gall midges, some species seem to be gall makers.

Tribe Lasiopterini

This group was created by Rübsaamen & Hedicke (1925–1939) for six genera in two subtribes, viz. Lasiopterina and Trotteriina. Enderlein (1936) added the subtribe Stefaniellina and Möhn (1966–1971) the subtribe Baldratiina.

By the end of 2003 the tribe contained 317 species in 16 genera which are distributed in all biogeographic regions. 236 species occur in the Palaearctic region, 37 species in the the Nearctic region, 3 species in the Neotropical, 10 species in the Afrotropical, 22 species in the Indomalayan and 16 species in the Australasian and Oceanian regions. Larvae of most Lasiopterini are gall makers, some of them cause stem swellings, some develop inside seeds of flower heads of Asteraceae. Symbiotic fungi develop in galls of some species. *Lasioptera* with 125 species is the richest genus occurring scattered in all biogeographical regions. Larvae of *L. yadokariae* Yukawa & Haitsuka, 1994 display a unique biology – they develop as successors in empty galls of other gall-inducing gall midges, feeding on mycelia growing in these galls (Yukawa & Haitsuka 1994). Two fossil species of the genus *Lasioptera* are known. *L. recessa* Scudder, 1877, was discovered in copal in the Nearctic region from the Eocene. One unidentified species of the genus *Lasioptera* was found in amber in the Baltic Region from the Eocene–Oligocene (Evenhuis 1994).

Tribe Trotteriini

Rübsaamen & Hedicke (1925–1939) created the subtribe Trotteriina for only one genus *Trotteria*. Möhn (1966) raised it to the tribe level. By the end of 2003 the tribe contained 17 species in one genus *Trotteria*. 9 species occur in the Palaearctic, 2 species in the Nearctic, 5 species in the Neotropical and one species in the Afrotropical region. Larvae of Trotteriini are inquilines in galls of gall midges of the supertribe Asphondyliidi. In some cases the larvae of *Trotteria* may even cause the death of larvae of the gall causer.

Unplaced genera and species of Lasiopteridi

By the end of 2003 six species in five genera which were described in the Neotropical region could not be placed in any of the above tribes of Lasiopteridi for lack information. All species are gall causers.

Supertribe Oligotrophidi

Felt (1911) and Kieffer (1913) used for this group of genera the name "Oligotrophariae". The supertribe Oligotrophidi was established by Rübsaamen & Hedicke (1925–1939). They divided 49 Palaearctic genera into six tribes, viz. Brachyneurini, Cystiphorini, Dasyneurini, Oligotrophini, Phegomyini and Poomyini. Some of these tribes were later reclassified. Möhn (1955), on the basis of studies of external structure of larvae, distinguished several groups (without naming them) which characterized some of these tribes at larval level. Sylvén (1975) and Sylvén & Tastás-Duque (1993) made important contributions to the study of Oligotrophidi. Gagné (1986) in his phylogenetical analysis considered the Oligotrophini to be a tribe of the supertribe Lasiopteridi and later (Gagné 2004) restricted the Oligotrophini to genera associated with host plants of the family Cupressaceae.

The supertribe Oligotrophidi is divided here into six tribes, the Dasineurini, Ledomyiini, Mikiolini new tribe, Oligotrophini, Poomyiini and Rhopalomyiini which are treated in alphabetical order.

By the end of 2003 the supertribe contained 1361 species in 108 genera which occur in all biogeographical regions of the world. Twelve species are known from fossils. 958 species occur in the Palaearctic region, 315 species in the Nearctic, 40 species in the Neotropical, 11 species in the Afrotropical, 17 species in the Indomalayan and 17 species in the Australasian and Oceanian regions. Most species, with the exception of Ledomyiini, are gall makers.

Tribe Dasineurini

Felt (1911) established a group "Dasyneurariae" which Rübsaamen & Hedicke (1925–1939) changed into the tribe Dasyneurini including 13 Palaearctic genera. By the end of 2003 this largest group of the supertribe Oligotrophidi contained 855 species in 51 genera which occur in all biogeographical regions of the world. The majority, 644 species, occur in the Palaearctic region, 170 species in the Nearctic, 15 species in the Neotropical, 6 species in the Afrotropical, 10 species in the Indomalayan and 9 species in the Australasian and Oceanian regions. One fossil unidentified species of the genus *Dasineura* was discovered in amber of the Baltic Region from the Eocene–Oligocene (Evenhuis 1994). The most species rich genus *Dasineura* including at present nearly 500 species has a cosmopolitan distribution. Most species of Dasineurini are gall-causers, some develop in flowerheads of Asteraceae or in flower buds of other plant groups without making galls and some are inquilines in galls of other gall midges or of other insects. About ten species of the genus *Dasineura* are pests of cultivated plants in the Palaearctic Region (Darvas et al. 2000).

Tribe Ledomyiini

The tribe Ledomyiini was established by Enderlein (1936) as a tribe of the supertribe Oligotrophidi with eight genera including *Ledomyia*. Gagné (1976) ranked in the tribe Ledomyiini only one genu*s*, *Ledomyia*, and considered this tribe to be a group of the supertribe Lasiopteridi. By the end of 2003 the tribe contained 54 species in 6 genera which occur scattered in the Palaearctic, Nearctic, Neotropical and Afrotropical regions. 22 species occur in the Palaearctic region, 19 species in the Nearctic, 3 species in the Neotropical and 4 species in the Afrotropical region. Adults are associated with decaying wood or logs, some species were found in galls of other insects and the biology of other species is unknown. Six fossil species of this tribe are found. One unidentified species of *Ledomyia* was discovered in amber in Mexico in the Neotropical region from the Oligocene–Miocene (Gagné 1973) and five species of *Ledomyiella* were discovered in amber in the Baltic region from the Eocene–Oligocene (Meunier 1904).

Tribe Mikiolini, new tribe

The new tribe is established here for the genus *Mikiola*, based on *Mikiola fagi* (Hartig, 1839). The genus *Mikiola* does not fit in other tribes of the Oligotrophidi. The unique character of this tribe is the unusual shape of the larval spatula with sternal papillae situated between the lobes of its anterior part and the number of terminal papillae which is reduced from eight to four.

By the end of 2003 the tribe contained only two species of one genus. Larvae of *Mikiola fagi* cause pointed galls on leaves of *Fagus sylvatica* in the western Palaearctic (Skuhravá 1987). The galls of this species were known to Plinius the Elder who lived in the first century P.Ch. Larvae of *Mikiola orientalis* (Kieffer, 1909) cause similar galls on leaves of *Fagus* sp. in Turkey. Evenhuis (1994) reported that two fossil species of the genus *Mikiola* are known. Impressions of galls of *Mikiola fagi* on leaves were found in copal in France from the Pliocene. Traces of galls which were identified as *Mikiola pontiensis* Villalta, 1957, found in Spain and originated from the Miocene (Diéguez et al. 1996) were misidentified. According to the photos I identified these galls to be caused by the gall midge species *Phegomyia fagicola* (Kieffer, 1913).

Tribe Oligotrophini

Felt (1911) created the group Oligotrophariae which Rübsaamen & Hedicke (1925–1939) rearranged and renamed in the tribe Oligotrophini. They included in it 14 Palaearctic genera. Sylvén & Tastás-Duque (1993) made important contributions to knowledge of this group. Gagné (2004) restricts this tribe very narrowly to the genus *Oligotrophus* and three other genera associated with junipers.

By the end of 2003 the tribe contained 164 species in 47 genera which occur in all biogeographical regions of the world. The majority, 100 species, occur in the Palaearctic region, 38 species in the Nearctic, 19 species in the Neotropical, one species in the Afrotropical, 6 species in the Indomalayan and 3 species in the Australasian and Oceanian regions. The majority of them are gall makers but some species live on plants without making galls. Five fossil species were discovered as impressions of galls on leaves of various trees, viz. *Didymomyia tiliacea* (Bremi, 1847), on leaves of *Tilia* sp. from the Pliocene until the present, *Phegomyia fagicola* (Kieffer, 1913) (fossil galls misidentified as *Mikiola fagi* by Diégez et al., 1996), *Hartigiola fossilis* Straus, 1977, traces of galls on leaves of *Fagus* sp. in Romania and Germany from the Pliocene, *Walshomyia cupressi* Gagné, 1969, impressions of galls on *Cupressus pygmaea* discovered in North America (in California) from the Pleistocene up to recent and *Acericecis chaneyi* (Cockerell, 1927), fossils galls on *Acer osmonti* in Oregon (USA) from the Miocene.

Tribe Poomyiini

Rübsaamen & Hedicke (1925–1939) established this tribe for 17 Palaearctic genera which are related to Oligotrophini but differ from them in having four segmented palpi. Gagné (2004) restricted this tribe to include only two genera, *Mayetiola* and *Epicalamus*, with species associated with Poaceae. By the end of 2003 the tribe contained 31 species of which 29 occur in the Palaearctic region and two species in the Nearctic region. *Mayetiola destructor* (Say, 1817) originating from Europe, was accidentally introduced to North America and New Zealand (Skuhravá et al. 1984b). It is a minor pest in Europe but is a serious pest in North America (Darvas et al. 2000).

Tribe Rhopalomyiini

Rübsaamen & Hedicke (1925–1939) established the subtribe Rhopalomyiina for eight genera, viz. *Phlyctidobia* Kieffer, *Bremiola* Rübsaamen, *Amerhapha* Rübsaamen, *Diarthronomyia* Felt, *Misospatha* Kieffer, *Rhopalomyia* Rübsaamen, *Boucheella* Rübsaamen and *Iteomyia* Kieffer. Some genera were later moved to other groups. Gagné (1973) redefined the genus *Rhopalomyia* and synonymized some previously described genera under this genus. Recently Gagné (2004) synonymized seven genera established by Fedotova, viz. *Absinthomyia*, *Arenaromyia*, *Dracunculomyia*, *Polynomyia*, *Pupascleromyia*, *Seriphidomyia* and *Yukawyx*, with many species occurring in Kazakhstan (Fedotova 2000), under the genus *Rhopalomyia* because no weighty, relevant and serious morphological characters were found to differentiate Fedotova's new genera from the genus *Rhopalomyia* Rübsaamen (see Gagné 2004).

Most species of *Rhopalomyia* cause galls or live as inquilines in galls of various types on host plants of the family Asteraceae, mainly on various species of the genus *Artemisia*. Few species are associated with other host plant genera of Asteraceae and only a very few species cause galls on species and genera of other plant families. Most species occur in semidesert and desert areas of the Palaearctic region (Fedotova 2000) and of the Nearctic region (Jones et al. 1983).

By the end of 2003 the tribe contained 255 species which are ranked in only one genus, *Rhopalomyia*. Most of them (161 species) occur in the Palaearctic region, mainly in Kazakhstan (about 110 species), 86 species occur in the Nearctic Region (Jones et al. 1983), three species in the Neotropical region, one native species, *Rhopalomyia haasi* Kieffer, 1905, and one introduced species, *Rhopalomyia millefolii* (Loew, 1850), in the Indomalayan region, and three native and one introduced species, *Rhopalomyia chrysanthemi* Ahlberg, 1939, in the Australasian and Oceanian regions. *R. chrysanthemi* is a pest of cultivated forms of chrysanthemum plants grown in glasshouses. Its origin is unknown, probably it came from Asia. At present it occurs scattered throughout the world. The galls of the European species *Rhopalomyia millefolii* were found also in India, very far outside its normal distribution area. *Rhopalomyia tripleurospermi* Skuhravá, 2000, larvae of which cause galls on *Tripleurospermum perforatum* (Asteraceae), were found and described in Europe. This species was introduced as a biological control agent into Canada where its host plant is considered to be a noxious and spreading weed (Skuhravá & Hinz 2000).

Supertribe Stomatosematidi

The supertribe Stomatosematidi with only one tribe, Stomatosematini, was established by Gagné (1975a). Only 18 species belonging in two genera, *Stomatosema* and *Didactylomyia*, occur in the biogeographical regions of the world, with the exception of the Australasian and Oceanian regions. No fossil species of this group were found. The biology of the species is unknown, some adults were caught in flight or at light. Females of *Stomatosema nemorum* Kieffer, 1904 were caught on wood and adults of *Didactylomyia longimana* (Felt, 1912) were found in spider webs (Gagné 1994).

DISCUSSION AND CONCLUSIONS

At the end of 2003, the Cecidomyiidae contained 5657 living and fossil species in 613 genera which are distributed in all biogeographical regions of the world. Of these, 3122 species in 344 genera occur in the Palaearctic, 1202 species in 181 genera in the Nearctic region, 520 species in 153 genera in the Neotropical, 203 species in 85 genera in the Afrotropical, 462 species in 109 genera in the Indomalayan and 212 species in 59 genera in the Australasian and Oceanian Regions. In the course of the 20th century the number of species and genera doubled in comparison with the 2500 species in 300 genera which were known from all regions of the world at the beginning of the 20th century

(Kieffer 1913). The family appears to be very rich both in species and genera but it is necessary to emphasize that only a small part of all existing gall midge species are known and described, as is evident from investigations which have started in new areas, as for example in Brazil (Maia 2001), Kazakhstan (Fedotova (2000) and Kamchatka (Mamaev 1994), or when new methods for collecting adults are used, as for example yellow dishes and Malaise traps (Jaschhof 1998).

The Cecidomyiidae occur in all biogeographical regions of the world but the distribution of species and genera is very unequal. This is connected mainly with the fact that only a few researchers have paid attention to areas outside the Palaearctic and Nearctic regions. The gall midge fauna of the Palaearctic region, mainly of its western part, is very well known because the study of the family Cecidomyiidae has a long history here and many researchers have been active in this area (Skuhravá et al. 1984). Nevertheless, large areas of this region remain unexplored, as for example from extensive areas of Siberia only sporadic data about the occurrence of gall midges are available. The gall midge fauna of the Far East and of Central Asia, where intensive investigations were made during the last twenty years, is better known. The species and genus numbers of the Palaearctic region increased over the last twenty years from 2200 species in 300 genera given by Skuhravá (1986) to 3122 species in 344 genera, mainly due to the investigations carried out in desert and semidesert areas of Kazakhstan by Fedotova (2000).

The species and genus numbers of the Nearctic region increased only slightly from 1190 species in 125 genera given by Foote (1965) to the present state of 1202 species in 181 genera, although very much has been done in this region and many new gall midge species and genera were decribed during the last fourty years. The reason for these moderate increases in total numbers lies in the fact that many species and genera which were described insufficiently at the beginning of the 20th century fell into synonymy through revisions of several groups of Cecidomyiinae by Gagné (1968b, 1969, 1975a, 1986, 1995) and in the revision of the Lestremiinae published by Jaschhof (1998).

The species and genus numbers for the Neotropical region increased by almost half in recent years from 360 species in 129 genera given by Gagné (1968) to 520 species in 153 genera, mainly due to the investigations of Maia (2001) and her collaborators carried out in Brazil.

The species and genus numbers of the Afrotropical region increased slightly in the last twenty years from 156 species in 75 genera given by Harris (1980) to 203 species in 85 but, apart from some pest and beneficial species, the Afrotropical Cecidomyiidae are virtually unstudied and unknown.

The species and genus numbers of the Indomalayan region increased moderately in the last thirty years from 332 species in 92 genera given by Gagné (1973) to 462 species in 109 genera, mainly due to the investigations of Grover and her students and collaborators at the University of Allahabad (India) (Grover 1981).

The species and genus numbers of Australasian and Oceanian regions are low and increased in the last 15 years only a little, from 210 species in 47 genera given by Gagné (1989a) to 239 species in 49 genera known from that area at present.

About a hundred species of Cecidomyiidae occur in both the Palaeactic and Nearctic regions and have a Holarctic distribution. Of these about 50 species are Lestremiinae, 7 are Porricondylinae and many species are zoophagous Cecidomyiinae (species of *Aphidoletes*, *Endaphis* and *Feltiella*) or species of unknown biology recorded only as caught adults (species of *Coquillettomyia* and *Karshomyia*). The remaining species of Holarctic Cecidomyiinae are immigrants from one to another region which have been brought with their host plants into new areas unintentionally by man. Such species may be designated as "secondarily Holarctic". Most of them are pests of cultivated plants and many are native (indigenous) in Europe, from where they were transferred to North America, as for example *Dasineura mali* (Kieffer, 1904) on cultivated varieties of *Malus* *sylvestris*, *D. pyri* (Bouché, 1847) on *Pyrus communis*; *Dasineura gentneri* (Pritchard, 1953), *D. leguminicola* (Lintner, 1879) and *D. trifolii* (F. Löw, 1874) on *Trifolium* spp.; and above all the major pest species, *Mayetiola destructor* (Say, 1817), at present a minor pest of cereals in Europe but a major pest of cereals in North America. Similarly two other major pests of cereals, *Contarinia tritici* (Kirby, 1798) and *Sitodiplosis mosellana* (Géhin, 1856), have their centres of origin in the western Palaeartic and were secondarily transferred to North America and other regions so that they now have a cosmopolitan distribution (Skuhravá et al.1984b, Darvas et al. 2000). Most species were unintentionally introduced into other biogeographical regions, as for example *Dasineura mali* and *D. pyri* from Europe to New Zeeland. Such species may be designated as secondarily cosmopolitan in their distribution.

A few species have their origin in North America and were unintentionally transferred to Europe, as for example *Janetiella siskiyou* Felt, 1917 (= *Craneiobia lawsonianae* De Meijere, 1935), larvae of which develop in cones of *Chamaecyparis lawsoniana*, and were probably transferred in seeds in cones; *Dasineura gleditchiae* (Osten Sacken, 1866), larvae of which cause galls on young leaflets of the ornamental tree *Gleditsia triacanthos*, were probably transferred with nursery stocks, and *Obolodiplosis robiniae* (Haldemann, 1847), larvae of which cause galls on leaflets of *Robinia pseudoacacia*, which were recently discovered in Italy and the Czech Republic (Duso & Skuhravá 2004, Skuhravá & Skuhravý 2004).

On the other hand, several species which are indigenous to the western Palaearctic are beneficial species that have been purposely transferred by man for biological control of pests or weeds in other biogeographical regions. For example, larvae of *Aphidoletes aphidimyza* (Rondani, 1847) are used for biological control of aphids; larvae of *Feltiella acarisuga* (Vallot, 1827) for control of spider mites (Tetranychidae, Acarina) in greenhouses; *Cystiphora schmidti* (Rübsaamen, 1914) and *C. sonchi* (Bremi, 1847) for control of their host plants (*Chondrilla juncea* and *Sonchus arvensis*, respectively) in Canada; *Zeuxidiplosis giardi* (Kieffer, 1896) for control of *Hypericum perforatum* and *Asphondylia ulicis* Trail, 1873 for biological control of *Ulex*, both in New Zealand, and recently *Rhopalomyia tripleurospermi* Skuhravá, 2000 for biological control of *Tripleurospermum maritimum* in Canada.

Fossil gall midge species which were discovered scattered in all biogeographical regions except the Australasian and Oceanian Regions were summarized by Evenhuis (1994). They give evidence of the geological age of the family. The oldest fossil species, *Catotricha mesozoica* Kovalev, 1990, found in Siberia from the Upper Jurassic and Lower Cretaceous, indicates that the oldest Cecidomyiidae probably originated and developed in the Mesozoic, 150 to 50 million years ago. Most fossil adults were discovered in amber and copal and several galls were found as impressions or traces on leaves of ancient trees. About 40 fossil species have been discovered in amber in the Baltic Region which originate from the Eocene to the Oligocene of the Cenozoic. They developed together with flowering plants. It may be estimated that these gall midges lived about 25 to 50 millions years ago.

Many gall midge species remain in the category “Unplaced species and genera”. These species and genera are insufficiently known and poorly described and usually the type specimens and other original material has been lost. At present it is not possible to place them in any taxonomic group. Some of them may be found in the future and after better recognition of their morphological characters and redescription they will be placed in a corresponding genus, as for example, was done with the gall midge species *Hartigiola faggalli* (Monzen, 1955), larvae of which cause galls on leaves of *Fagus crenata* in Japan. This species was originally described as *Oligotrophus faggali* Monzen, 1955. Gall midge species of the genus *Oligotrophus* are usually associated with host plants of the genus *Juniperus*. Sato & Yukawa (2004) reared adults and, after examination of morphological characters, they placed the Japanese species *faggalli* in the genus *Hartigiola*, together with the European species *Hartigiola annulipes* (Hartig, 1839) larvae of which cause galls on leaves of *Fagus sylvatica*.

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